# MARION CONTRACTORS' HANDBOOK

(F) - 1-30-34 R'c'd - DENVER, COLO.

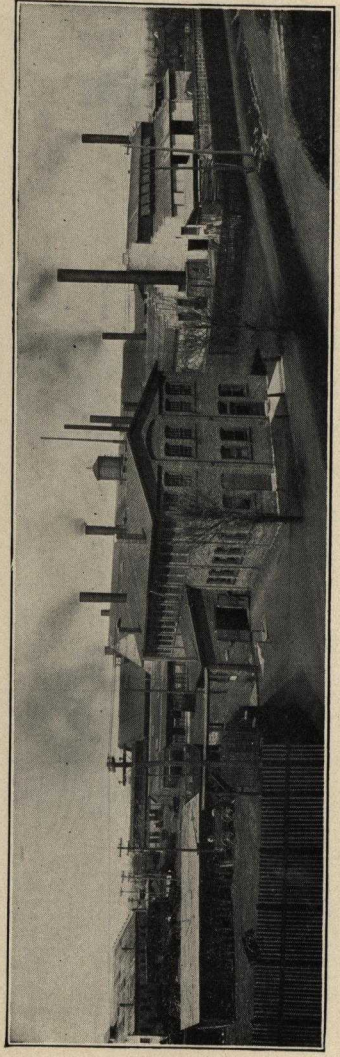
# CONCRETE FORM WORK

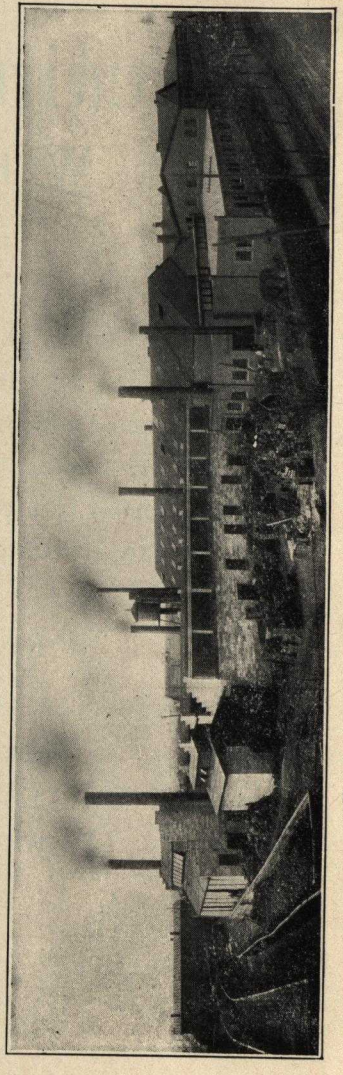
A compilation of details and tables of use to the engineer, architect, contractor and boss formwork carpenter, together with descriptions of Marion Contractors' Specialties used in erecting wood centering.

*Price $1.00*

Published by
MARION MALLEABLE IRON WORKS
Marion, Indiana

1932





VIEWS OF THE MARION MALLEABLE IRON WORKS.

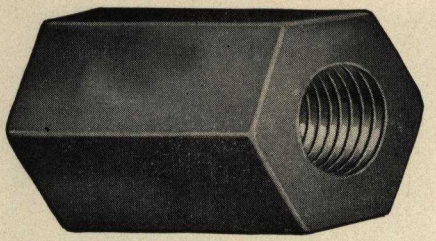
# *Introduction*

TO PLACE in the hands of contractors, architects, engineers, construction superintendents and formwork carpenters authentic information on the design, construction and erection of concrete centering, this book is issued.

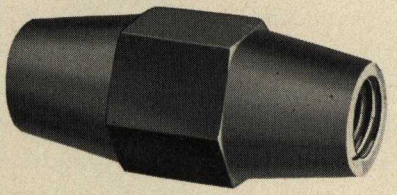
It illustrates and describes in detail the use of Marion Specialties for a great variety of purposes. Here, also, will be found a mass of miscellaneous information, compiled for quick and easy reference at the drawing board or on the job. Obviously so small a volume cannot begin to carry all of the detailed data that a complete handbook should contain. An effort has been made to publish here those figures and those details most often needed and to bind them in so small a compass as to allow the book to slip easily into the pocket.

Aside from the description of Marion Specialties, none of the material presented is original. We have reason to thank the publishers of the magazine *Concrete,* A. B. MacMillan, Scientific Book Corpn., publishers of William Arthur's *New Building Estimators' Handbook,* Universal-Atlas Cement Co., Koehring Company, A. Leschen & Sons Rope Co., and Harry Parker, A. I. A., Editor-in-Chief of *Kidder-Parker Architects' and Engineers' Handbook,* published by John Wiley & Sons, Inc., for permission to publish copyrighted matter.

MARION MALLEABLE IRON WORKS.



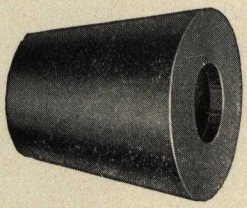
Marion Hex Coupling



Marion Semi-Hex Coupling

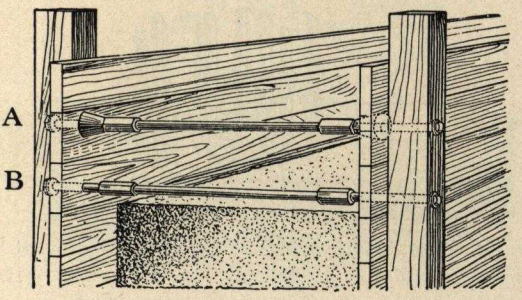
These hexagonal and semi-hex couplings are used for a variety of purposes in construction work. A few uses are explained on the following three pages.

The couplings are of Marion Certified Malleable Iron and are stocked in sizes threaded to take bolts ½, ⅝, ¾, ⅞, 1, 1⅛, 1¼, 1½ and 1¾ inches. Larger sizes furnished when required.



Marion Form Spreader

These malleable spreader castings are used as shown on the opposite page. They are furnished in sizes to accommodate bolts as listed above.

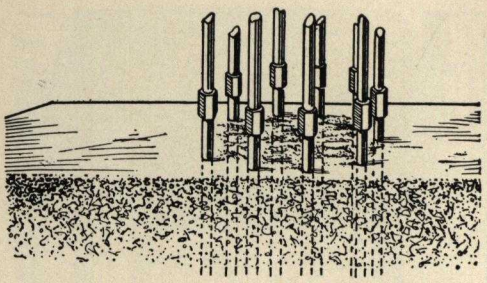



## Marion Hex Couplings and Spreaders Used in Form Work

On each end of a threaded rod of proper length, spin a Hex coupling. Pass a stud bolt through the form from each side. Slip a spreader over the bolt before inserting the bolt in the Hex coupling. Draw the bolts tight and you have a combination form tie and form spreader as shown above at A. If a simple tie is required, omit spreaders as at B. The result is a strong tie, capable of accurate adjustment. No skilled labor required.

In wrecking forms, simply remove the bolts and spreaders, leaving rod and couplings embedded in the concrete. Their cost is much less than the cost of cutting or burning off an ordinary rod tie. Holes are easily grouted. Thus you have no clamps to lose, no rods to cut, no rust streaks.

Marion Hex Couplings were used in the complicated centering for the Muscle Shoals Dam and are specified on other important jobs. Railway construction engineers recommend them.

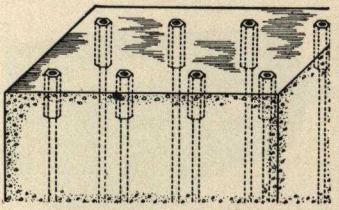


## Marion Hex Couplings Provide Continuous Reinforcement

An important use of Hex Couplings is common practise in securing continuity of reinforcement in structures where continuous pouring is impractical. This practise is encountered especially in bridge and retaining wall work.

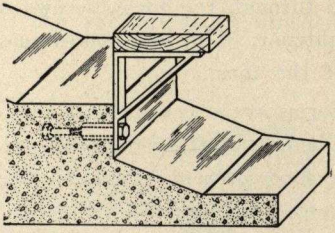
In circular structures, continuous reinforcement is achieved by joining hoop rods with the Hex Coupling.

Many contractors butt-joint their steel on all their work, rather than lap it. Hex Couplings save steel and cut the cost of fabrication. They fill all government requirements for continuous reinforcement in bridge and dam work.



## Provision for Future Extensions

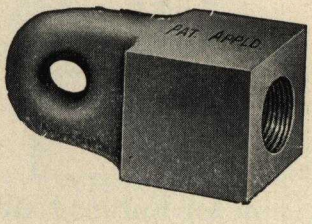
Steel dowels are provided for attaching new extensions to old construction, by the use of Marion Hex Couplings. Either in floor slabs or in columns, short steel rods are embedded, threaded on one end. Hex Couplings spun on, come flush with the finished work. The open half of each coupling is filled with grease and the future construction joint coated with tar, leaving the embedded dowels already to function whenever additions to the construction are to be made.



## Making All Kinds of Attachments

There are literally hundreds of places where Hex Couplings function efficiently as inserts. Installation is easy, as during construction they are held accurately in place by removable bolts passed through the centering. The sketch shows a method of attaching seat brackets in stadiums and similar structures, worked out by Prof. J. Hammond Smith, Department of Civil Engineering, University of Pittsburgh.

Similar applications may be made in attaching pipe hangers, signs, brackets, radiators, shaft hangers and machinery to walls, ceilings and floors.

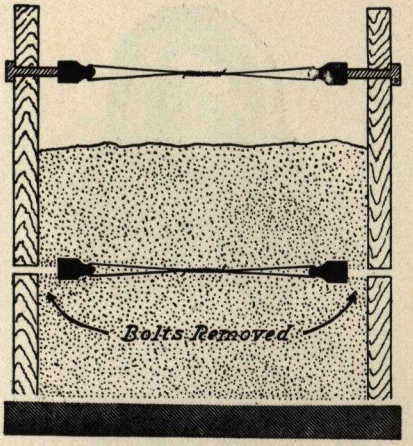



## Marion Wire Form Tightener

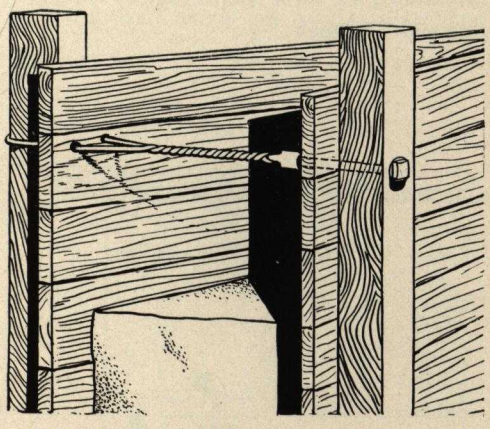
Marion Form Tighteners for use with wire ties provide an economical and speedy method of aligning wood centering. One or two tighteners are used with each tie, as shown opposite, depending on the character of the work. In either case the wire tie passes through the eyelet and a bolt, passed through the form, screws into the threaded hole in the tightener. This bolt makes possible the accurate adjustment of the form.

When the forms are wrecked, bolts are removed and kept for re-use, The holes left by the bolts are grouted and the surface of the work presents a smooth finish. No wires to snip, no danger of rust spots.

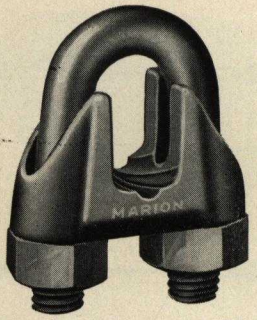
Marion Wire Form Tighteners are carried in stock for immediate delivery in sizes to take ½, ⅝, ¾, ⅞ and 1 inch bolts.




Two Marion Tighteners used on each tie when both sides of the wall are to be finished.

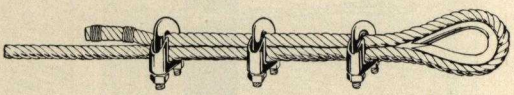


One Marion Tightener used on finish side when only one side of wall is to be finished.

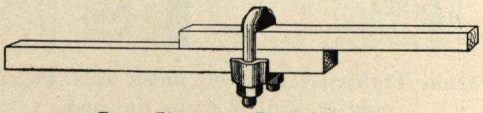



## Marion Cable Clips

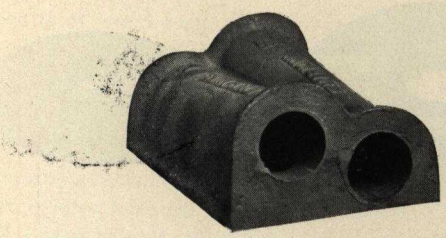
Marion Cable Clips are strong, sturdy and persistent in their grip. They are made of Marion Certified Malleable Iron, with steel U-Bolts having cold rolled threads. They are widely used on cables and for lap-jointing reinforcing steel bars, either square, round, twisted or deformed. Furnished Japanned in these sizes: 1/4, 5/16, 3/8, 1/2, 5/8, 3/4, 7/8, 1, 1 1/8 and 1 1/4 inch.



Clamping Guy Wires



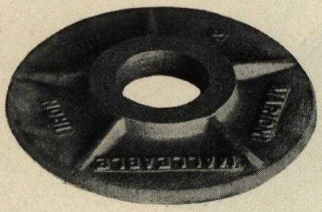
Lap-Jointing Reinforcing

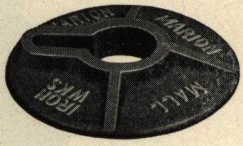


# Marion Tank Lugs

Marion Tank Lugs are made of Marion Certified Malleable Iron—strong, tough and shock resisting. They are used for cinching rod bands on tanks, silos and other similar structures.

| Size of Band | Pattern | Size of Hole | Weight | Length | Height | Width |
|---|---|---|---|---|---|---|
| 3/8 | Tack | 15/32 | 0.45 | 2 5/8 | 1 1/4 | 1 13/16 |
| 1/2 | Tale | 19/32 | 0.70 | 4 | 1 3/8 | 2 |
| 5/8 | Tell | 23/32 | 1.00 | 3 15/16 | 1 9/16 | 2 7/16 |
| 3/4 | Tend | 27/32 | 1.40 | 4 1/4 | 1 15/16 | 2 11/16 |
| 7/8 | Tool | 31/32 | 2.25 | 5 5/16 | 2 5/16 | 3 |
| 1 | Tone | 1 3/32 | 2.65 | 5 3/4 | 2 11/16 | 3 5/16 |
| 1 1/8 | Toss | 1 7/32 | 3.25 | 6 5/8 | 3 | 4 |
| 1 1/4 | Tuft | 1 11/32 | 4.50 | 6 5/8 | 3 1/8 | 4 1/4 |
| 1 1/2 | Turf | 1 19/32 | 7.75 | 7 7/16 | 3 5/16 | 5 3/16 |




# Marion Washers

These malleable, shock-proof castings find a variety of uses in construction work, in oil fields, shipyards, railway maintenance departments, etc., wherever spacers are required for bolts, tie-rods, braces and similar equipment.

| Size of Rod | Pattern | Diameter of Hole | Diameter of Washer | Thickness | Weight |
|---|---|---|---|---|---|
| 3/8 | Waft | 15/32 | 2 5/16 | 1/4 | 0.14 |
| 1/2 | Wage | 19/32 | 2 1/2 | 1/4 | 0.20 |
| 5/8 | Weed | 23/32 | 2 3/4 | 5/16 | 0.25 |
| 3/4 | Welt | 27/32 | 3 | 7/16 | 0.35 |
| 7/8 | Wend | 31/32 | 3 7/16 | 7/16 | 0.45 |
| 1 | Wing | 1 3/32 | 3 15/16 | 1/2 | 0.65 |
| 1 1/8 | Wipe | 1 7/32 | 4 1/2 | 9/16 | 0.85 |
| 1 1/4 | Wish | 1 11/32 | 5 1/16 | 5/8 | 1.40 |
| 1 1/2 | Wolf | 1 19/32 | 5 15/16 | 3/4 | 1.85 |
| 1 3/4 | Wool | 1 27/32 | 6 | 3/4 | 2.00 |
| 2 | Work | 2 3/32 | 7 3/8 | 13/16 | 4.00 |

# Concrete Form Work

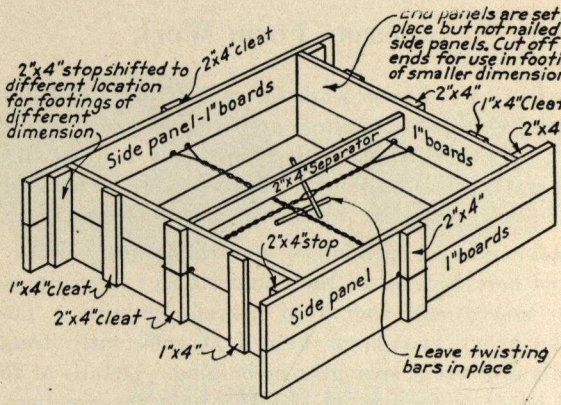
Details of wood form work for various parts of buildings and other concrete structures are presented on the following 35 pages to bring to the contractor a more definite knowledge of form economy. These details are taken from various sources and are representative of modern practice.

Certain general principles governing form work are repeated here because of their importance: Forms must be rigidly braced and shored to prevent collapse. Timber must be heavy enough or braced at sufficiently frequent intervals to prevent springing or bulging. Details of forms should be so devised as to simplify both the erection and removal of forms and to permit re-use of individual form units.

Both erection and removal of forms will be greatly simplified by using Marion Hex Couplings as form ties, Marion Spreaders and Marion Wire Tighteners. In many other cases the use of special double-headed form nails and column clamps will prove economical. When Marion specialties are used the form work employed in one set of footings, floor panels, wall sections or columns may be removed with the least possible damage and used repeatedly in other parts of the structure.

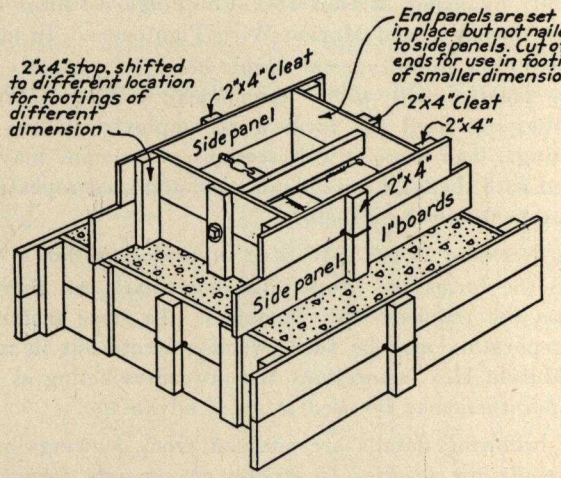
It is necessary to use spacers or separators within a wall to hold the forms the proper distance apart and thereby maintain the required wall thickness. In some instances these separators may be short wooden struts but in most cases Marion Hex connections and spreaders acting as ties and separators, may be used to great advantage.

The following details are adapted from drawings originally made for a series of articles on concrete formwork written by A. B. MacMillan and printed in the magazine *Concrete*. Acknowledgment is here made of our indebtedness to *Concrete* for permission to republish them.



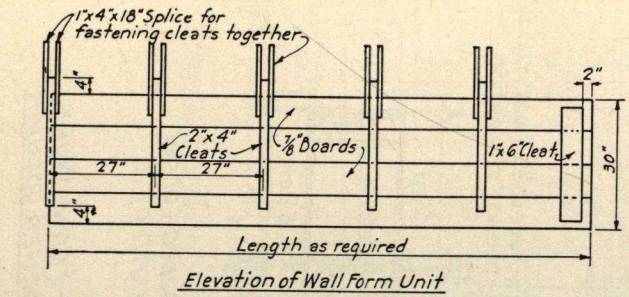

DETAIL OF FORM PANELS IN PLACE, TIED WITH TWISTED WIRES

FIGURE 1—FORMS FOR BOX FOOTING

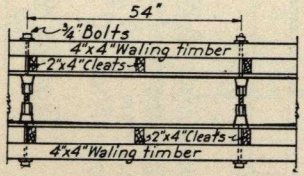

End panels are set in place but not nailed to side panels. Cut off ends for use in footing of smaller dimension
2"x4" stop, shifted to different location for footings of different dimension
2"x4" cleat
Side panel
2"x4" Cleat
2"x4"
2"x4"
1" boards
Side panel

FORM PANELS IN PLACE FOR UPPER STEP AFTER LOWER STEP IS CONCRETED - BRACED WITH SEPARATORS AND WIRE FORM TIGHTENER

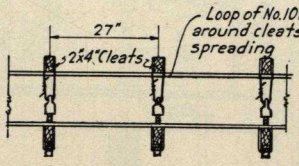
FIGURE 2-FORMS FOR STEPPED FOOTING



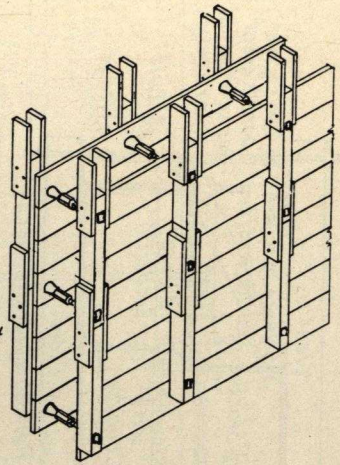

Elevation of Wall Form Unit




Plan of Wall Form Using Couplings, Separators, Waling Strips & Tie Bolts

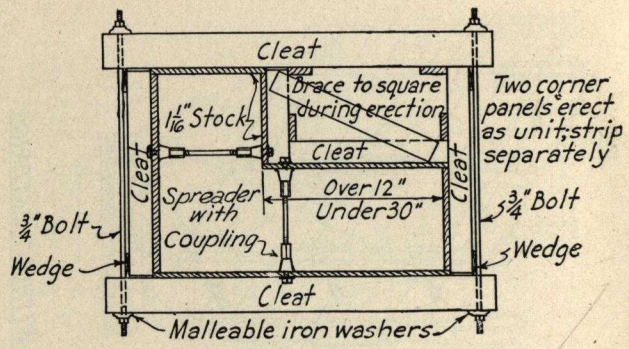



Plan of Wall Form Using Wire Form Tighteners

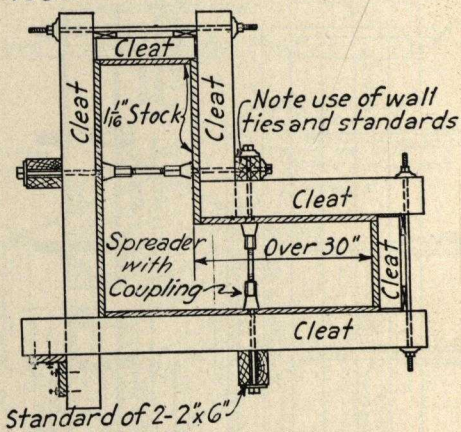


Isometric View Showing 2 Tiers of Wall Form Units Assembled

FIGURE 3-DETAILS OF WALL FORMS WITHOUT EXTERIOR BRACING




(b) Form for L-Shaped Corner Column with Length of L From 12" to 30"




(c) Form for L-Shaped Corner Column With Length of L More Than 30"

FIGURE 4— FORM WORK FOR CORNER COLUMN

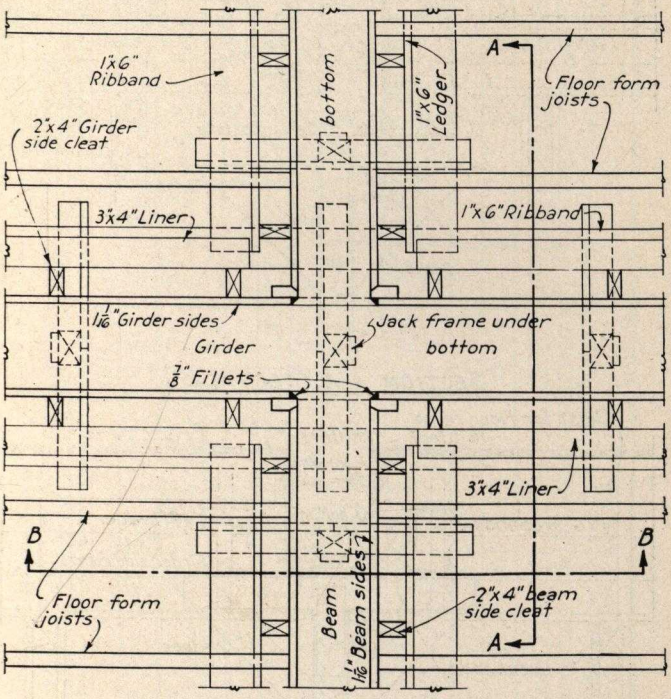
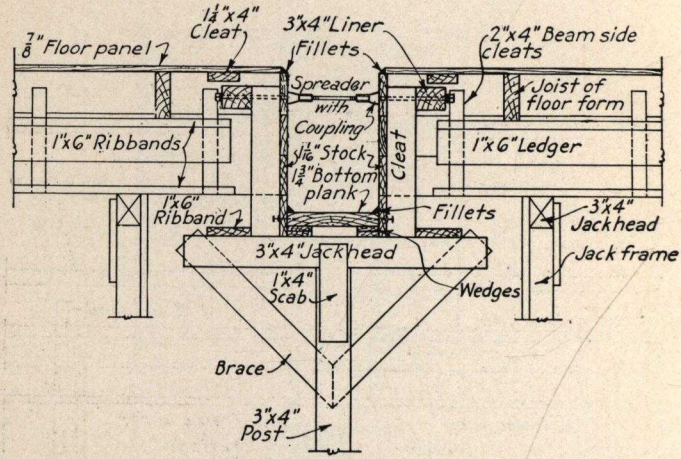
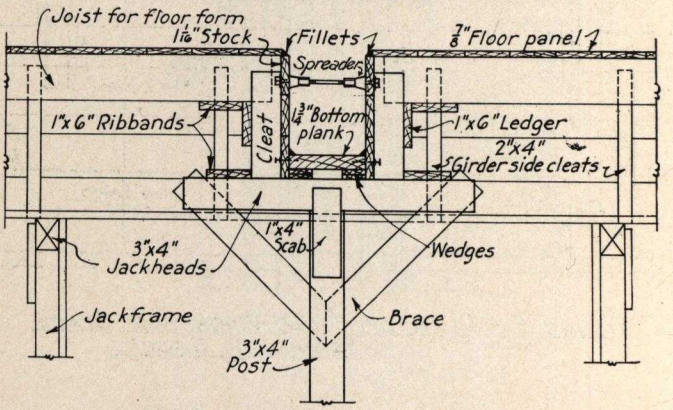



FIGURE 5 - PLAN OF FORM WORK FOR SLABS BEAMS AND GIRDERS




SECTION A-A (SEE FIG. 5)




SECTION B-B (SEE FIG. 5)

FIGURE 6 – CROSS SECTION THROUGH FORMS FOR BEAM AND GIRDER

## FIGURE 7—SPACING OF JOISTS, IN INCHES, FOR FLOOR FORM PANELS.

| SIZE OF JOIST | CLEAR SPAN IN FEET | THICKNESS OF CONCRETE SLAB, IN INCHES | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2½ | 3 | 3½ | 4 | 4½ | 5 | 5½ | 6 | 6½ | 7 | 7½ | 8 | 8½ | 9 |
| 2"x6" | 5 | 27 | 27 | 27 | 27 | 27 | 27 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 |
| | 6 | 27 | 25 | 23 | 21 | 20 | 19 | 18 | | | | | | | |
| | 7 | 20 | 18 | | | | | | | | | | | | |
| 2"x8" | 6 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 26 | 24 | 23 | 22 |
| | 7 | 27 | 27 | 27 | 27 | 26 | 25 | 23 | 22 | 21 | 20 | 18 | | | |
| | 8 | 27 | 25 | 23 | 21 | 20 | 19 | 18 | | | | | | | |
| | 9 | 21 | 19 | 18 | | | | | | | | | | | |
| 2"x10" | 8 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 26 | 25 | 24 | 22 | 21 | 21 | 20 |
| | 9 | 27 | 27 | 27 | 26 | 25 | 23 | 22 | 21 | 19 | 18 | | | | |
| | 10 | 26 | 25 | 23 | 21 | 20 | 19 | 18 | | | | | | | |
| | 11 | 23 | 21 | 19 | | | | | | | | | | | |

Note:- The above table is based on use of ⅞" form boards, which accounts for the maximum joist spacing of 27 inches. Heavier floor boards would permit greater joist spacing but would add greatly to the weight of the panels.

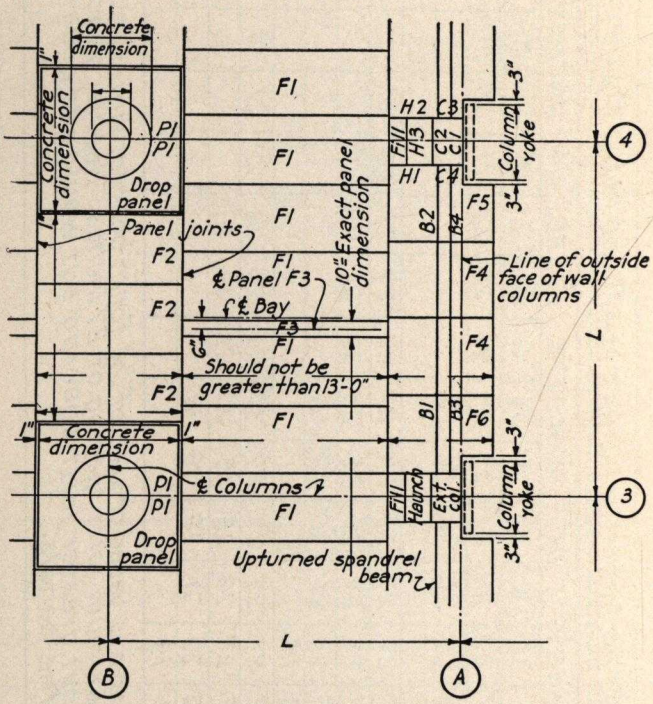



FIGURE 8—KEY PLAN, TYPICAL EXTERIOR FLOOR BAY

(Showing layout of form panels and markings for columns, haunches and spandrel beams.)

Note:- Allow $\frac{1}{8}$" clearance in all dimensions in all panels.

Note:- F3 panel is for reshoring and remains in place until all re-shores are removed.
Draw in panels on only one typical bay across building when making a key-plan.

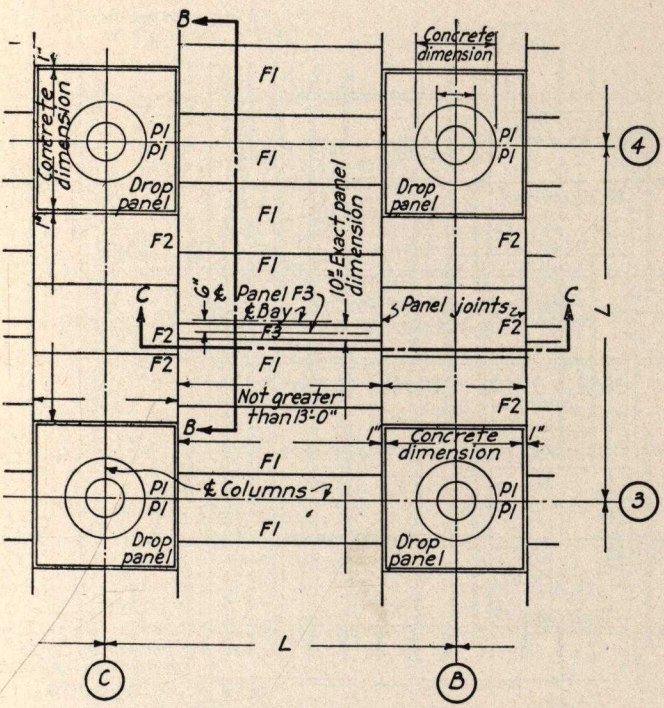
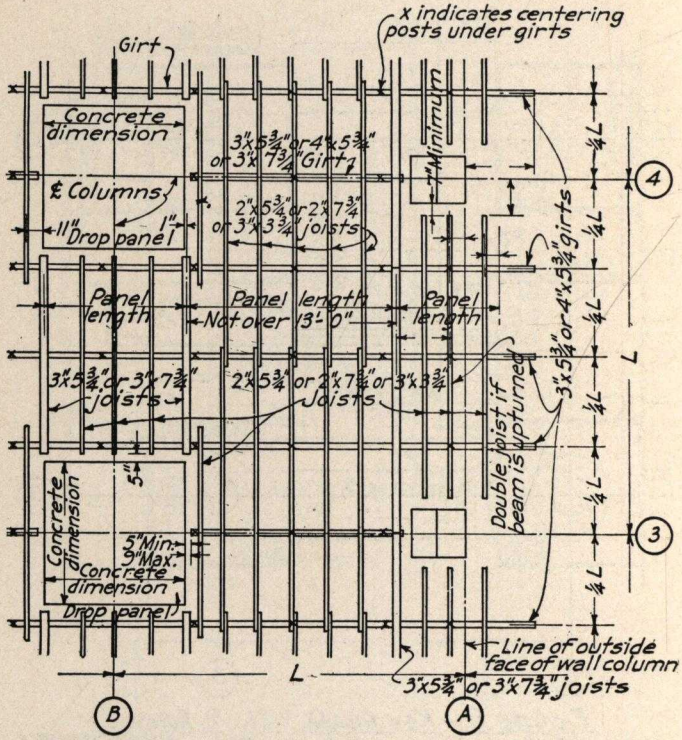



FIGURE 9 — KEY PLAN, TYPICAL INTERIOR FLOOR BAY
(Showing layout of form panels)

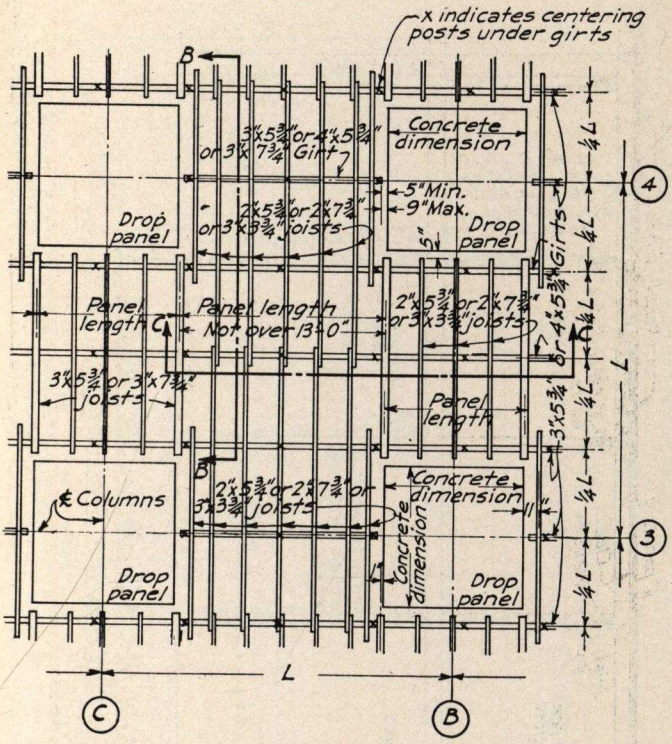
Note:- Allow 1/8" clearance in all dimensions in all panels

Note:- F3 panel is for re-shoring and remains in place until all re-shores are removed.
Draw in panels on only one typical bay across building when making key-plan




Note:-
Use a single joist 3" in thickness for joist at panel joint.
5¾" or 7¾" dimensions means sized stock; that is, 6" or 8" sized to 5¾" or 7¾"

**FIGURE 10-GENERAL ASSEMBLY, TYPICAL EXTERIOR FLOOR BAY**
(Floor form panels omitted)




Note:-
Use a single joist 3" in thickness for joist at panel joint.
5¾" or 7¾" dimension means sized stock; that is, 6" or 8" sized to 5¾" or 7¾"

## FIGURE 11– GENERAL ASSEMBLY TYPICAL INTERIOR FLOOR BAY

(Floor form panels omitted)

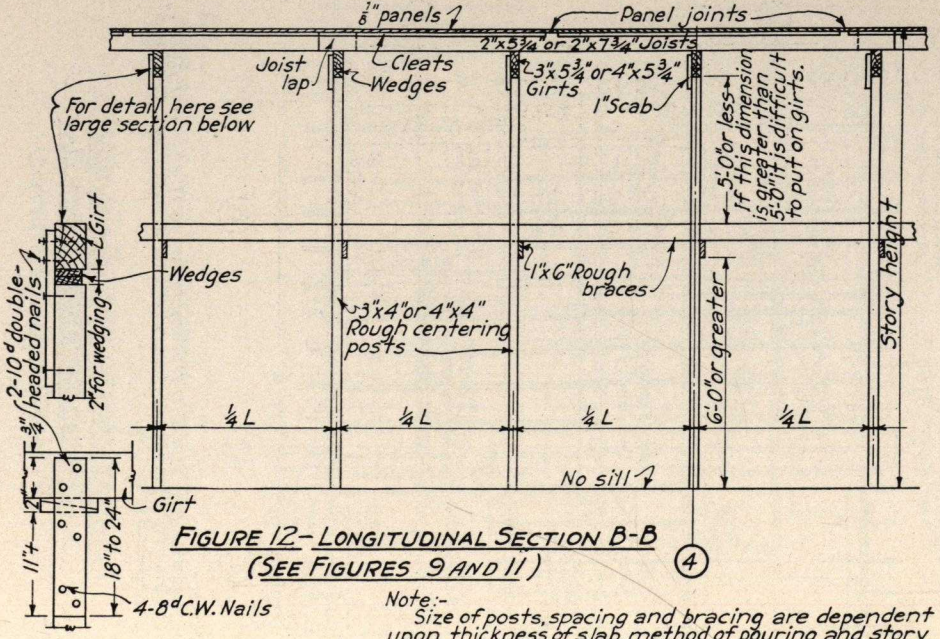



FIGURE 12 – LONGITUDINAL SECTION B-B
(SEE FIGURES 9 AND 11)

Note:-
Size of posts, spacing and bracing are dependent upon thickness of slab, method of pouring and story height. See large sized detail for scabs, wedges and nailing.

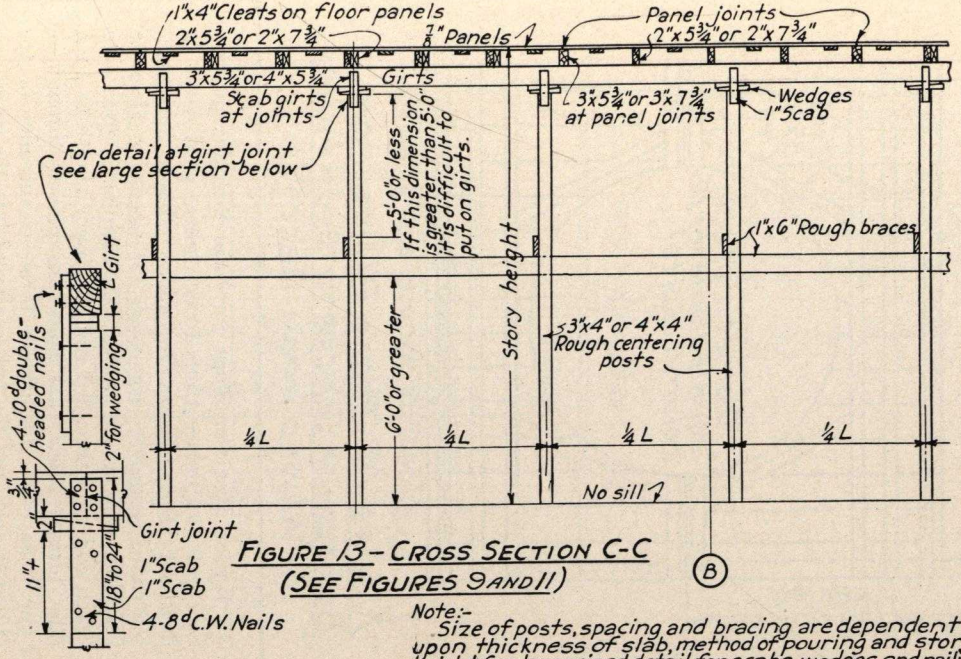



FIGURE 13 – CROSS SECTION C-C
(SEE FIGURES 9 AND 11)

Note:- Size of posts, spacing and bracing are dependent upon thickness of slab, method of pouring and story height. See large sized detail for scabs, wedges and nailing

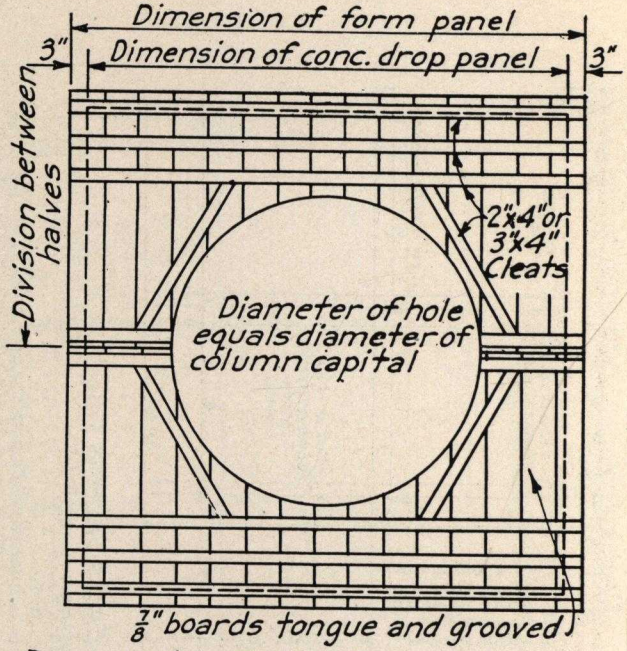



FIGURE 14—FORM PANEL FOR BOTTOM OF CONCRETE DROP PANEL (VIEWED FROM BELOW)

Marion Hex Couplings for form ties give positive accurate adjustment of forms when used with or without Marion Form Spreaders. These hexagonal threaded couplers are used for securing absolute rigidity on accurate work. One coupler is spun onto each end of a threaded rod of proper length to span the form. Then stud bolts are passed through,—one from each side of the form—a spreader is applied to each and the bolts screwed into the couplings bringing the forms into exact adjustment.

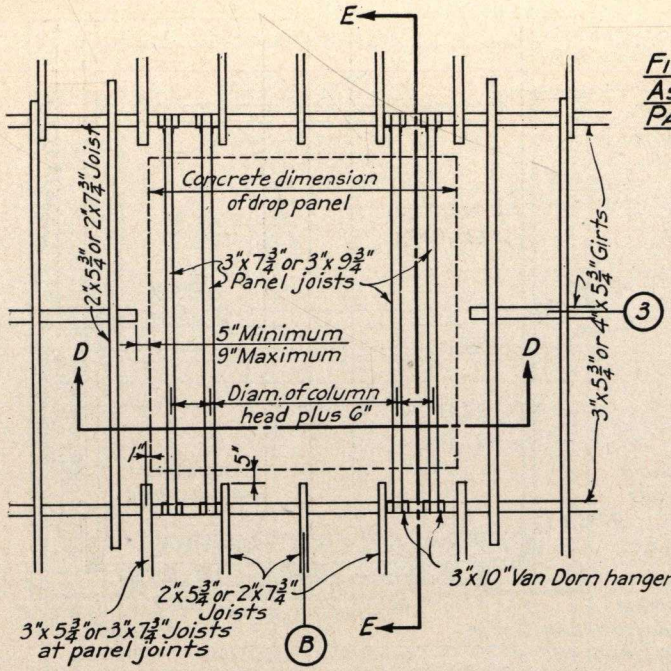



FIGURE 15 – TYPICAL ASSEMBLY FOR DROP PANEL FORM WORK

Note:-
Panel joists should be heavy enough if possible so that jack-frame supports will not be necessary.

See FIGURES 16 and 17 for sections.

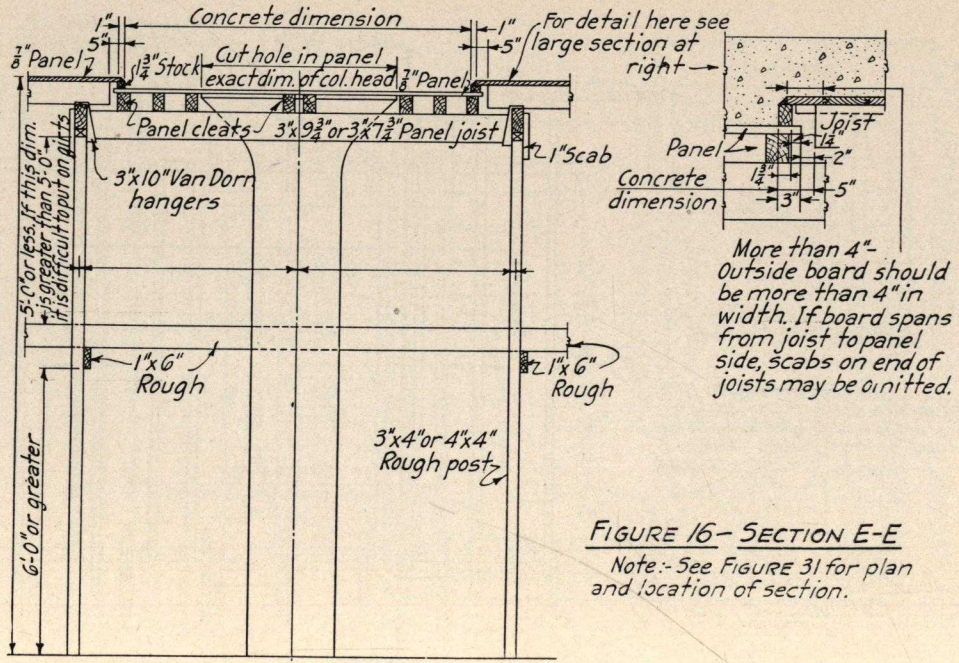

Concrete dimension
1"
5"
1"
5"
For detail here see large section at right
7/8" Panel
1 3/4" Stock
Cut hole in panel exact dim. of col. head
7/8" Panel
Panel cleats
3"x 9 3/4" or 3"x 7 3/4" Panel joist
1"Scab
3"x10" Van Dorn hangers
5'-0" or less. If this dim. is greater than 5'-0" it is difficult to put on glitts
1"x6" Rough
1"x6" Rough
3"x4" or 4"x4" Rough post
6'-0" or greater
Joist
Panel
Concrete dimension
1 1/4"
2"
1 1/2"
3"
5"
More than 4"- Outside board should be more than 4" in width. If board spans from joist to panel side, scabs on end of joists may be omitted.

FIGURE 16– SECTION E-E

Note:- See FIGURE 31 for plan and location of section.

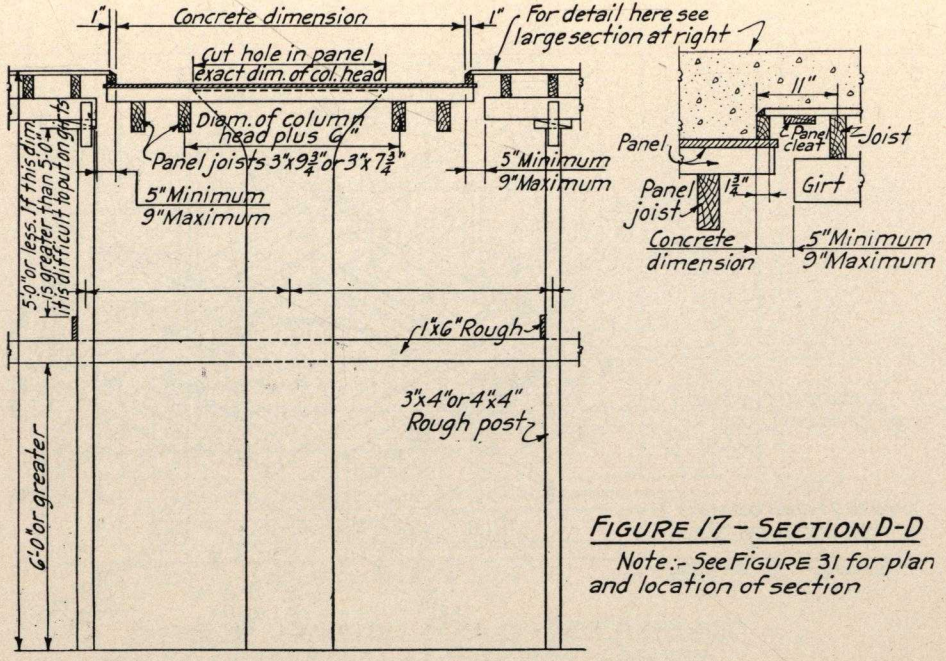



FIGURE 17 – SECTION D-D

Note:- See FIGURE 31 for plan and location of section

FIGURE 18 FORMS FOR DROP PANEL (VIEWED FROM BELOW)

Note:- See Figures 15, 16 and 17 for details

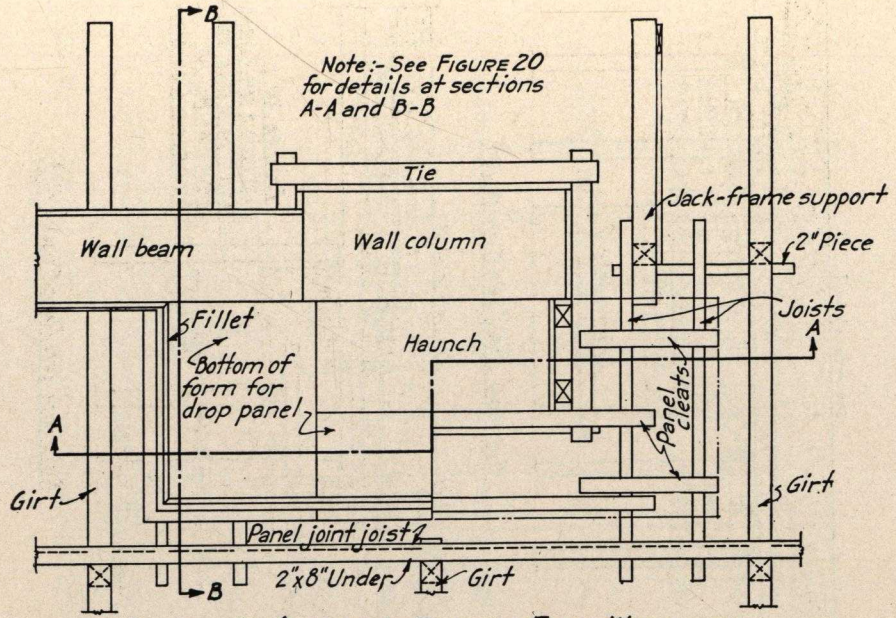
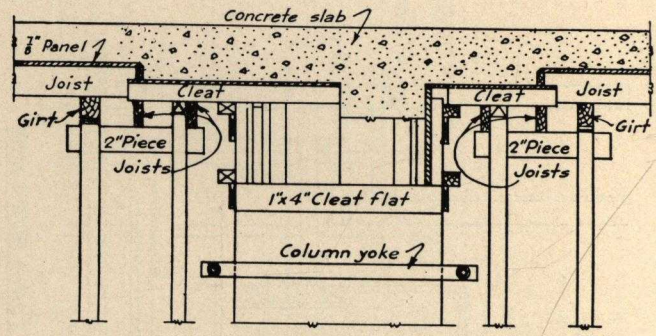



FIGURE 19 ASSEMBLY PLAN OF FORM WORK FOR ONE HALF DROP PANEL AT EXTERIOR COLUMN




SECTION A-A (See Figure 19)

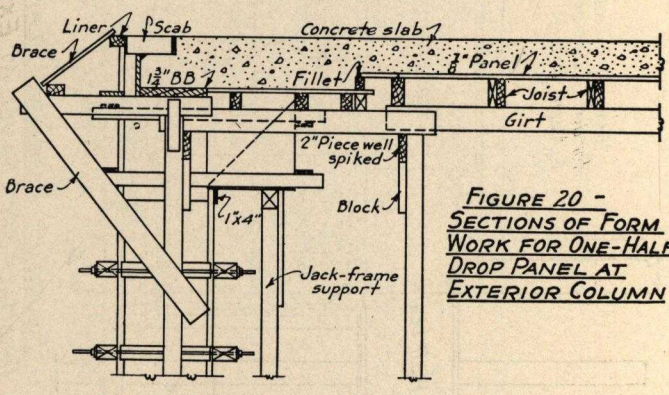
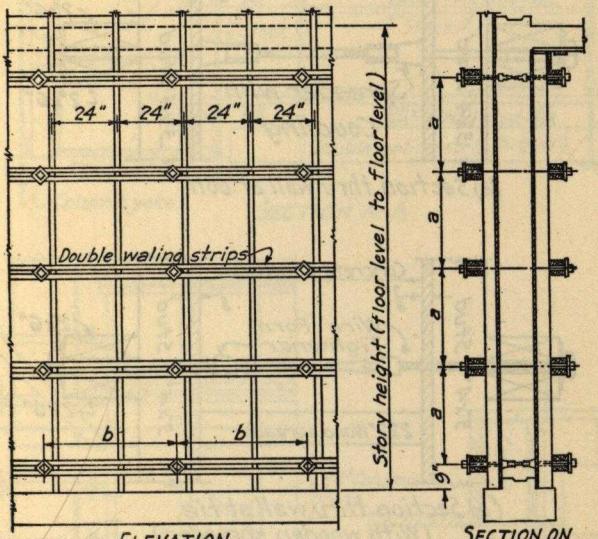



FIGURE 20 - SECTIONS OF FORM WORK FOR ONE-HALF DROP PANEL AT EXTERIOR COLUMN

SECTION B-B (See Figure 19)




| Concreting Schedule | | |
|---|---|---|
| Ft. per hour | a | b |
| 3'-0" | 3'-6" | 4'-6" |
| 4'-0" | 3'-0" | 4'-0" |
| 5'-0" | 2'-4" | 3'-9" |
| 6'-0" | 2'-0" | 3'-6" |

Above schedule applies to walls with 3"x4" studs and 2"x 6" double waling strips.

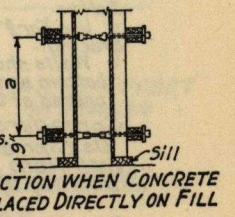
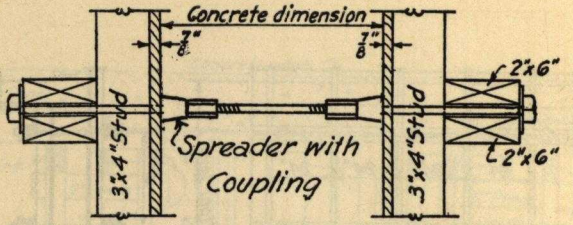
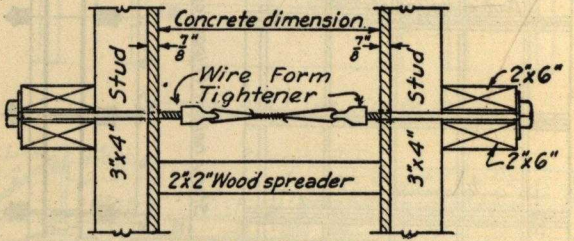



FIGURE 21 – TYPICAL WALL FORM ASSEMBLY




(a) Section thru wall at bolt




(b) Section thru wall at tie (With wooden spreader)

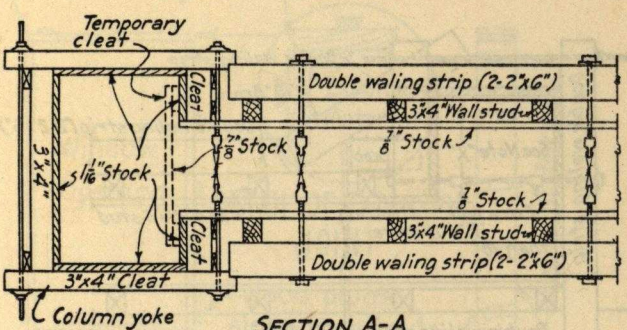
Notes:-

Bolts:-
Use $\frac{3}{4}$" or $\frac{5}{8}$" bolts.

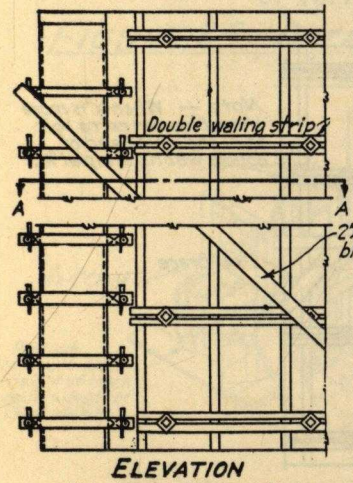
Bracing:-
Walls should be well braced at top and bottom and if over 6 ft. high they should be braced at 6 ft. vertical intervals

Spreaders:-
Use spreaders in walls to prevent the wall from being drawn in when bolting up.

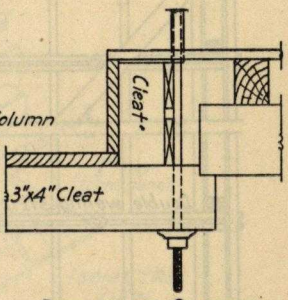
**FIGURE 22- DETAILS AND NOTES ON TYPICAL WALL ASSEMBLY**




SECTION A-A




ELEVATION




DETAIL OF OFFSET AT CORNER

FIGURE 23- DETAIL WHERE WALL FRAMES INTO COLUMN OR PILASTER (WALL OFFSET ON BOTH SIDES)

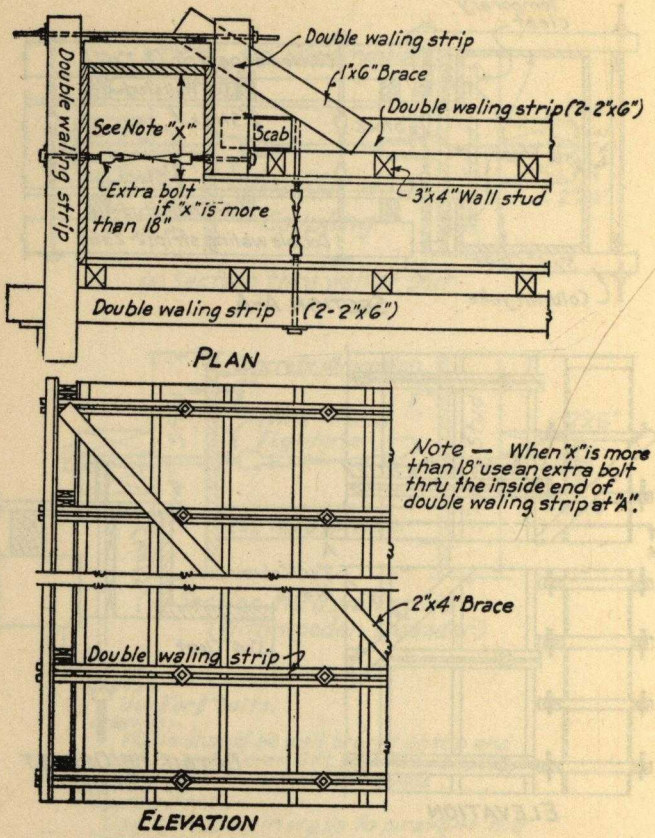

Double waling strip
1"x6" Brace
Double waling strip (2-2"x6")
Double waling strip
See Note "X"
Scab
Extra bolt if "x" is more than 18"
3"x4" Wall stud
Double waling strip (2-2"x6")
PLAN
Note — When "x" is more than 18" use an extra bolt thru the inside end of double waling strip at "A".
2"x4" Brace
Double waling strip
ELEVATION

FIGURE 24—DETAIL WHERE WALL FRAMES INTO COLUMN OR PILASTER (WALL FLUSH WITH ONE SIDE)

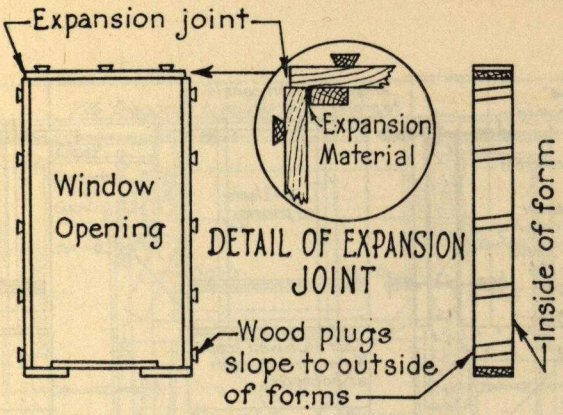
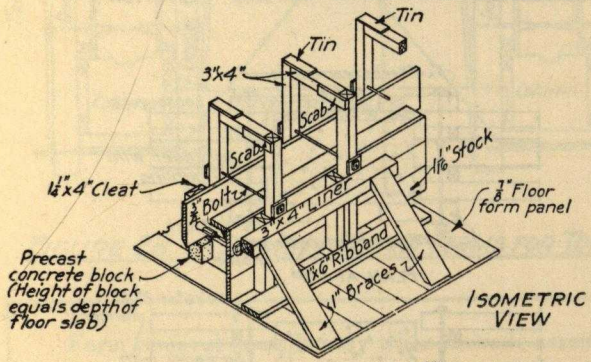



FIGURE 25 – DETAIL OF FALSE WINDOW FRAME



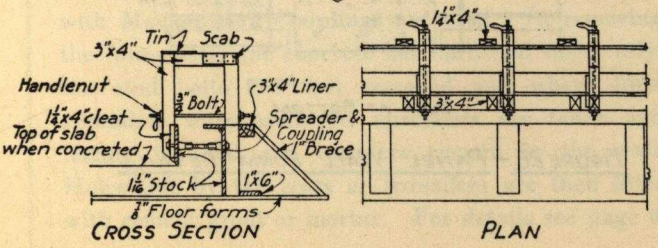
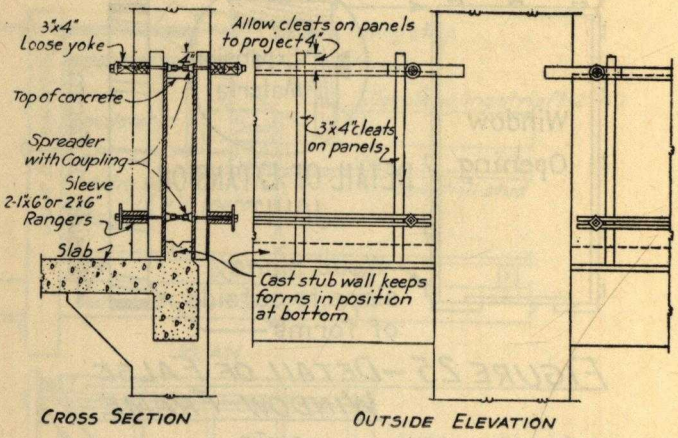




FIGURE 27 – FORMS FOR SPANDREL OR UPTURNED WALL BEAM



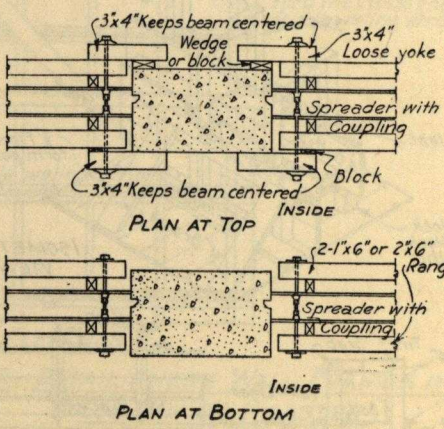




FIGURE 26 - PANEL WALL FORM DETAILS

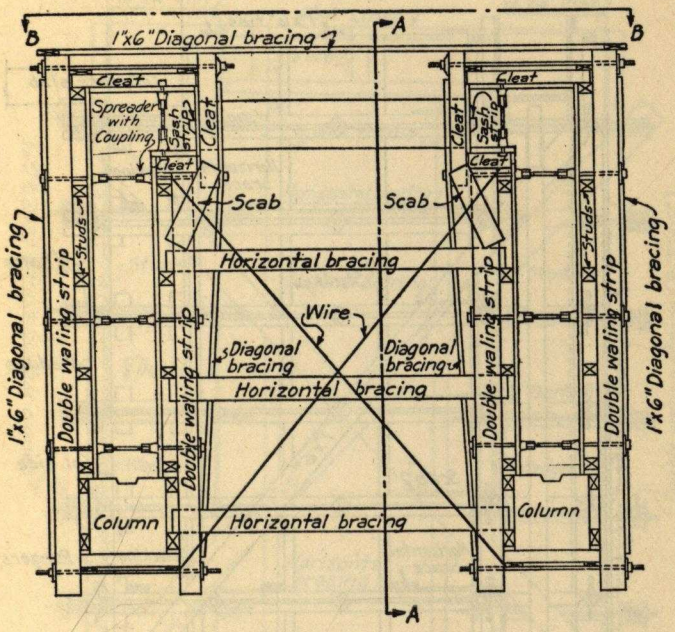



FIGURE 28 - ASSEMBLY PLAN OF FORMS FOR TOWER

Form removal is made easy when tie rods assembled with Marion Hex Couplings are used. In removing the forms after the concrete has hardened sufficiently, the stud bolts are first removed and where form spreaders were used, the spreaders are taken out, letting the rod and couplers remain in the wall. Holes left by the bolts or spreaders are then filled with cement grout or mortar. For details see page 5.

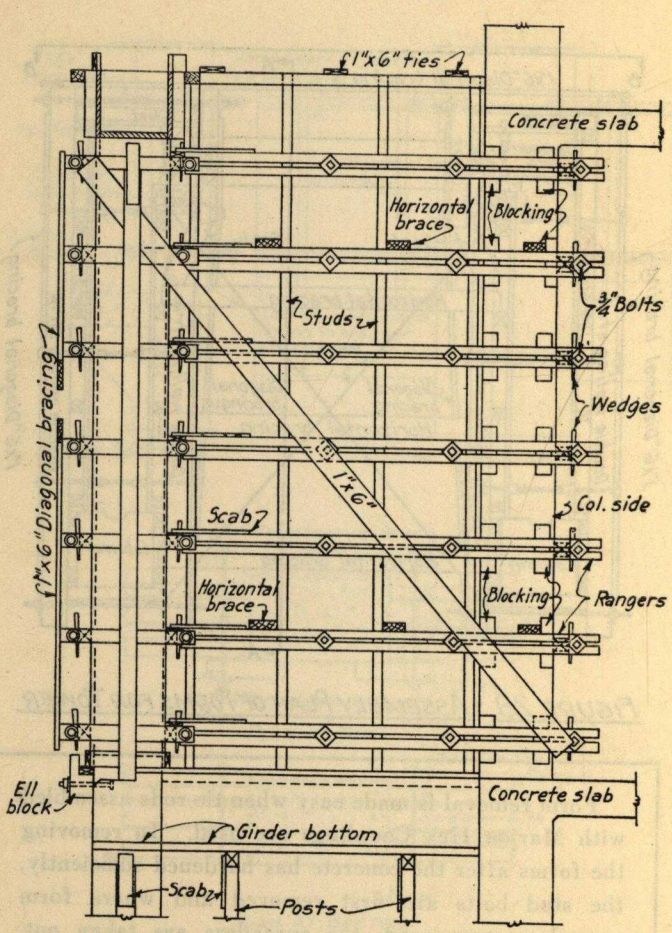



FIGURE 29 - SECTION A-A (IN FIGURE 28)

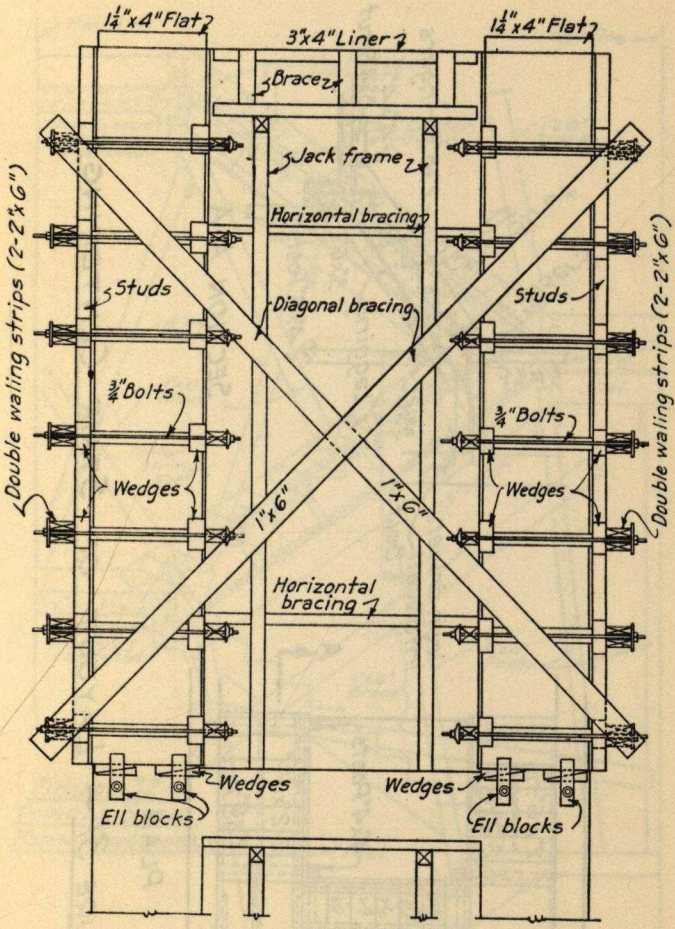



FIGURE 30— ELEVATION AT B-B (IN FIGURE 28)

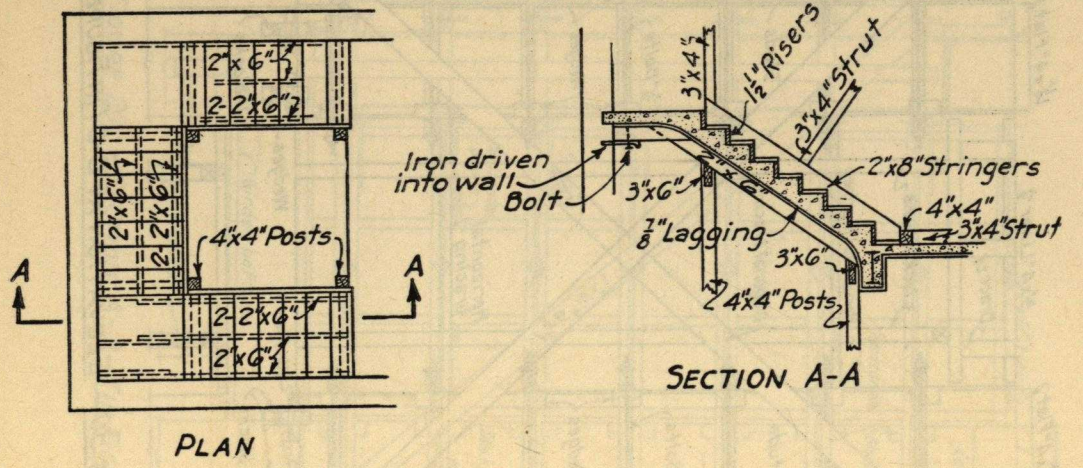



FIGURE 31 — LAYOUT OF STAIR CENTERING

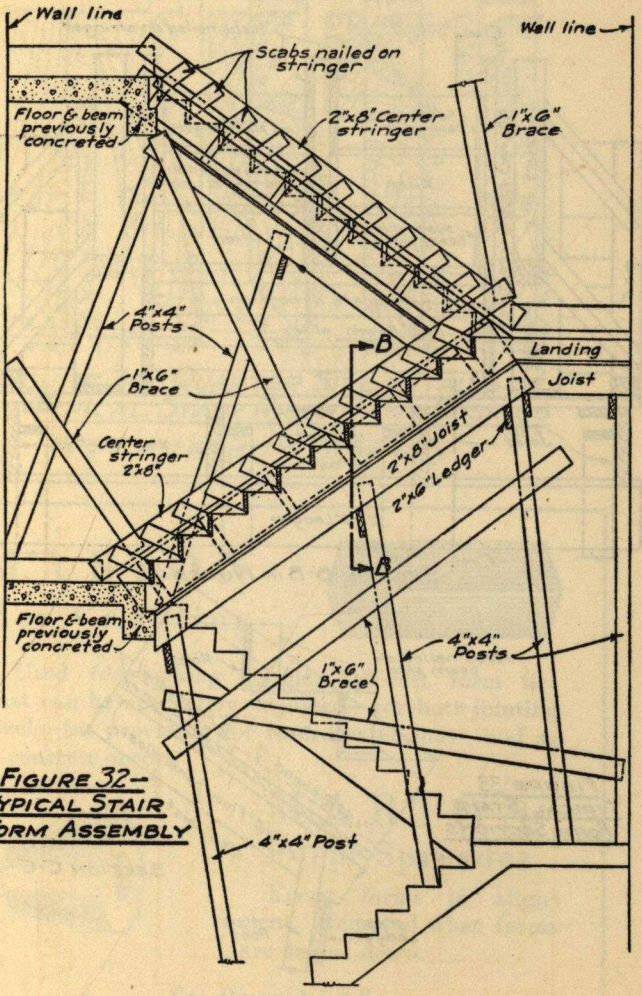
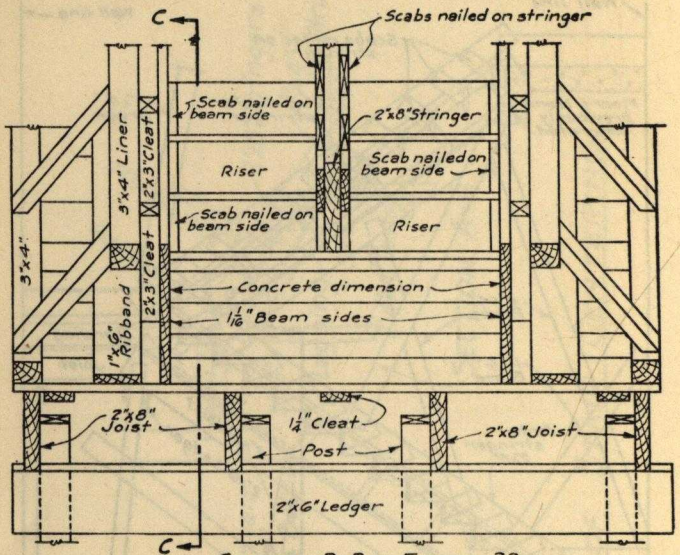
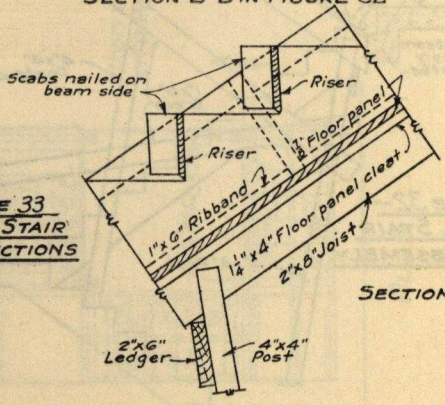



FIGURE 32—
TYPICAL STAIR
FORM ASSEMBLY




SECTION B-B IN FIGURE 32




SECTION C-C

FIGURE 33
TYPICAL STAIR
FORM SECTIONS

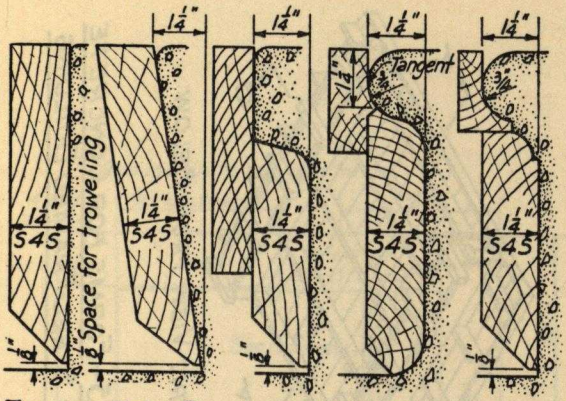
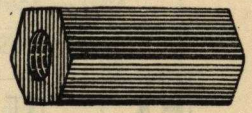


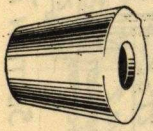

FIGURE 34—QUARTER SIZE DETAILS OF TYPICAL STAIR RISERS AND NOSINGS

*Height and projection may vary*

## MARION
### Hex Coupling



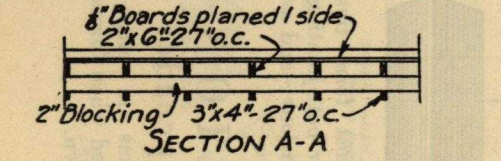
Used for making simple, low-cost form ties that can be accurately adjusted—for butt-jointing steel—for providing for future extensions—and as a concrete insert.



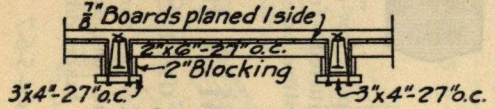
## MARION
### Form Spreader

Keeps forms in alignment. Removed when forms are taken down.

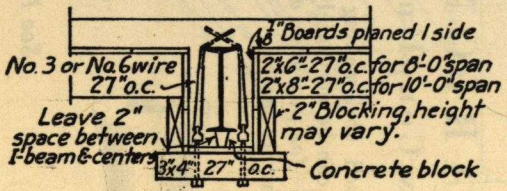
*See Pages 4-5-6-7*



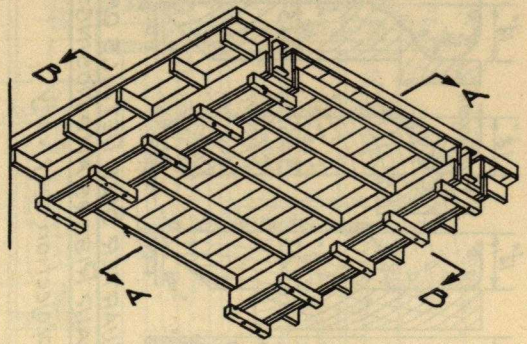

SECTION A-A




SECTION B-B


⅞" Boards planed 1 side
No. 3 or No. 6 wire 27" o.c.
2"x6"-27" o.c. for 8'-0" span
2"x8"-27" o.c. for 10'-0" span
Leave 2" space between I-beam & centers
2" Blocking, height may vary.
3"x4" 27" o.c.
Concrete block

SECTION THROUGH BEAM




ISOMETRIC VIEW FROM BELOW

FIGURE 35 - FORMS FOR CONCRETE FLOOR IN STEEL-FRAMED BUILDING

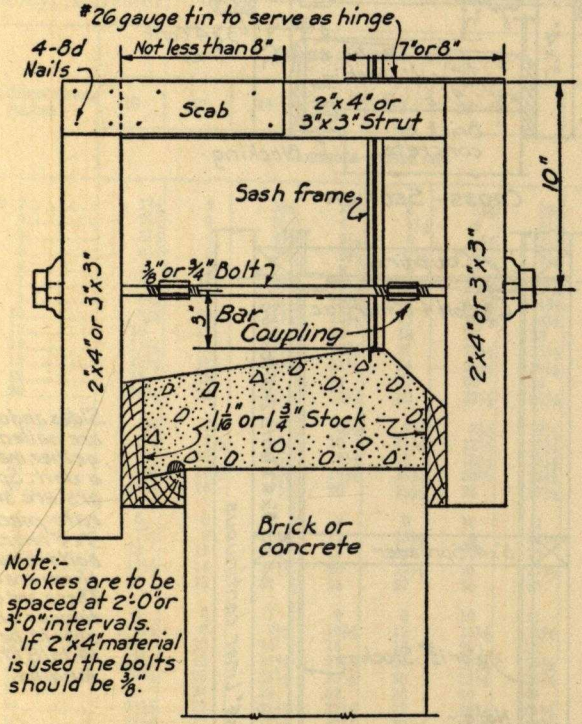
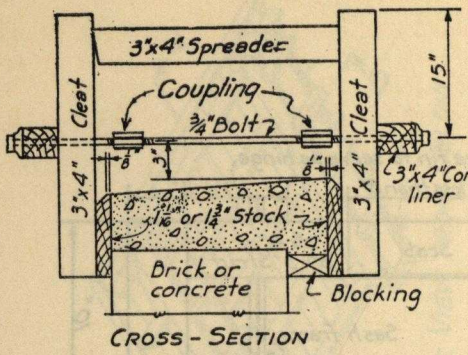
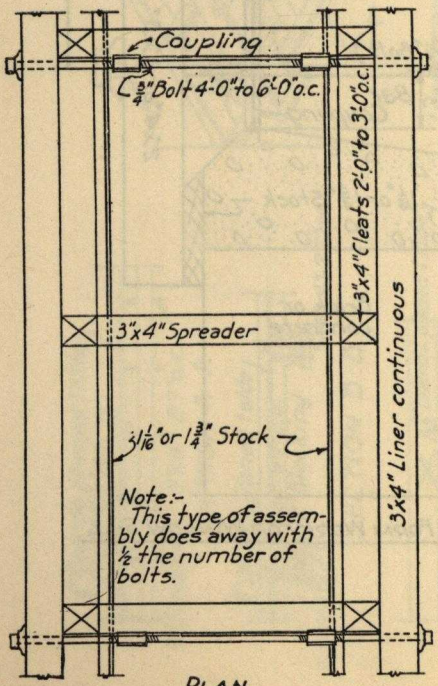



FIGURE 36 – FORM WORK FOR WINDOW SILL




CROSS - SECTION


Coupling
3/4" Bolt 4'-0" to 6'-0" o.c.
3"x4" Cleats 2'-0" to 3'-0" o.c.
3"x4" Spreader
1 1/16" or 1 3/4" Stock
Note:- This type of assembly does away with 1/2 the number of bolts.
3"x4" Liner continuous

PLAN

Sides and cleats are nailed together, making a unit. Spreaders are separate pieces. 3"x4" liners with bolts through them are a unit. These are continuous and should be in 14 to 18 ft. lengths.

FIGURE 37- FORM WORK FOR COPING

# Board Measure

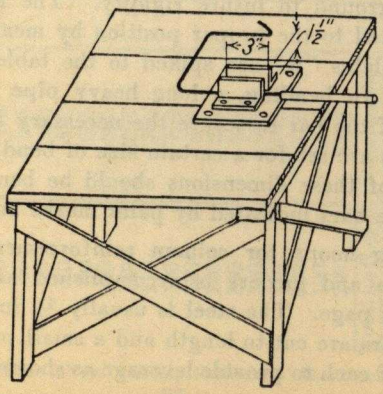
The tables of board measure appearing on pages 48, 49 and 50 are from "Instructions for the Scaling and Measurement of National-Forest Timber," issued by the U. S. Department of Agriculture, Forest Service, William B. Greeley, Forester.

| End dimensions, inches | Length of timber—feet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| | Contents—board feet | | | | | | | |
| 1 x 2 | 1⅔ | 2 | 2⅓ | 2⅔ | 3 | 3⅓ | 3⅔ | 4 |
| 3 | 2½ | 3 | 3½ | 4 | 4½ | 5 | 5½ | 6 |
| 4 | 3⅓ | 4 | 4⅔ | 5⅓ | 6 | 6⅔ | 7⅓ | 8 |
| 5 | 4⅙ | 5 | 5⅚ | 6⅔ | 7½ | 8⅓ | 9⅙ | 10 |
| 6 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 7 | 5⅚ | 7 | 8⅙ | 9⅓ | 10½ | 11⅔ | 12⅚ | 14 |
| 8 | 6⅔ | 8 | 9⅓ | 10⅔ | 12 | 13⅓ | 14⅔ | 16 |
| 10 | 8⅓ | 10 | 11⅔ | 13⅓ | 15 | 16⅔ | 18⅓ | 20 |
| 12 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 14 | 11⅔ | 14 | 16⅓ | 18⅔ | 21 | 23⅓ | 25⅔ | 28 |
| 16 | 13⅓ | 16 | 18⅔ | 21⅓ | 24 | 26⅔ | 29⅓ | 32 |
| 18 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 20 | 16⅔ | 20 | 23⅓ | 26⅔ | 30 | 33⅓ | 36⅔ | 40 |
| 1¼ x 4 | 4⅙ | 5 | 5⅚ | 6⅔ | 7½ | 8⅓ | 9⅙ | 10 |
| 6 | 6¼ | 7½ | 8¾ | 10 | 11¼ | 12½ | 13¾ | 15 |
| 8 | 8⅓ | 10 | 11⅔ | 13⅓ | 15 | 16⅔ | 18⅓ | 20 |
| 10 | 10⅜ | 12½ | 14⅝ | 16⅔ | 18¾ | 20⅚ | 22¾ | 25 |
| 12 | 12½ | 15 | 17½ | 20 | 22½ | 25 | 27½ | 30 |
| 1½ x 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 6 | 7½ | 9 | 10½ | 12 | 13½ | 15 | 16½ | 18 |
| 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 10 | 12½ | 15 | 17½ | 20 | 22½ | 25 | 27½ | 30 |
| 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 2 x 3 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 4 | 6⅔ | 8 | 9⅓ | 10⅔ | 12 | 13⅓ | 14⅔ | 16 |
| 6 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 8 | 13⅓ | 16 | 18⅔ | 21⅓ | 24 | 26⅔ | 29⅓ | 32 |
| 10 | 16⅔ | 20 | 23⅓ | 26⅔ | 30 | 33⅓ | 36⅔ | 40 |
| 12 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 14 | 23⅓ | 28 | 32⅔ | 37⅓ | 42 | 46⅔ | 51⅓ | 56 |
| 16 | 26⅔ | 32 | 37⅓ | 42⅔ | 48 | 53⅓ | 58⅔ | 64 |
| 2½ x 12 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 14 | 29⅙ | 35 | 40⅚ | 46⅔ | 52½ | 58⅓ | 64⅙ | 70 |
| 16 | 33⅓ | 40 | 46⅔ | 53⅓ | 60 | 66⅔ | 73⅓ | 80 |
| 3 x 4 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 6 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 8 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 10 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 12 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 14 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| 16 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |

(Table Continued on Page 50)

| End dimensions, inches | Length of timber—feet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| | Contents—board feet | | | | | | | |
| 4 x 4 | 13⅓ | 16 | 18⅔ | 21⅓ | 24 | 26⅔ | 29⅓ | 32 |
| 6 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 8 | 26⅔ | 32 | 37⅓ | 42⅔ | 48 | 53⅓ | 58⅔ | 64 |
| 10 | 33⅓ | 40 | 46⅔ | 53⅓ | 60 | 66⅔ | 73⅓ | 80 |
| 12 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 14 | 46⅔ | 56 | 65⅓ | 74⅔ | 84 | 93⅓ | 102⅔ | 112 |
| 5 x 8 | 33⅓ | 40 | 46⅔ | 53⅓ | 60 | 66⅔ | 73⅓ | 80 |
| 6 x 6 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 8 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 10 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 12 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 14 |
| 14 | 70 | 84 | 98 | 112 | 126 | 140 | 154 | 168 |
| 16 | 80 | 96 | 112 | 128 | 144 | 160 | 176 | 192 |
| 8 x 8 | 53⅓ | 64 | 74⅔ | 85⅓ | 96 | 106⅔ | 117⅓ | 128 |
| 10 | 66⅔ | 80 | 93⅓ | 106⅔ | 120 | 133⅓ | 146⅔ | 160 |
| 12 | 80 | 96 | 112 | 128 | 144 | 160 | 176 | 192 |
| 14 | 93⅓ | 112 | 130⅔ | 149⅓ | 168 | 186⅔ | 205⅓ | 224 |
| 10 x 10 | 83⅓ | 100 | 116⅔ | 133⅓ | 150 | 166⅔ | 183⅓ | 200 |
| 12 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 |
| 14 | 116⅔ | 140 | 163⅓ | 186⅔ | 210 | 233⅓ | 256⅔ | 280 |
| 16 | 133⅓ | 160 | 186⅔ | 213⅓ | 240 | 266⅔ | 293⅓ | 320 |
| 12 x 12 | 120 | 144 | 168 | 192 | 216 | 240 | 264 | 288 |
| 14 | 140 | 168 | 196 | 224 | 252 | 280 | 308 | 336 |
| 16 | 160 | 192 | 224 | 256 | 288 | 320 | 352 | 384 |
| 14 x 14 | 163⅓ | 196 | 228⅔ | 261⅓ | 294 | 326⅔ | 359⅓ | 392 |
| 16 | 186⅔ | 224 | 261⅓ | 298⅔ | 336 | 373⅓ | 410⅔ | 448 |
| 18 | 210 | 252 | 294 | 336 | 378 | 420 | 462 | 504 |
| 16 x 16 | 213⅓ | 256 | 298⅔ | 341⅓ | 384 | 426⅔ | 469⅓ | 512 |
| 18 | 240 | 288 | 336 | 384 | 432 | 480 | 528 | 576 |
| 20 | 266⅔ | 320 | 373⅓ | 426⅔ | 480 | 533⅓ | 586⅔ | 640 |
| 18 x 18 | 270 | 324 | 378 | 432 | 486 | 540 | 594 | 648 |
| 20 x 20 | 333⅓ | 400 | 466⅔ | 533⅓ | 600 | 666⅔ | 733⅓ | 800 |
| 22 x 22 | 403⅓ | 484 | 564⅔ | 645⅓ | 726 | 806⅔ | 887⅓ | 968 |
| 24 x 24 | 480 | 576 | 672 | 768 | 864 | 960 | 1, 056 | 1, 152 |
| 26 x 26 | 563⅓ | 676 | 788⅔ | 901⅓ | 1, 014 | 1, 126⅔ | 1, 239⅓ | 1, 352 |
| 28 x 28 | 653⅓ | 784 | 914⅔ | 1, 045⅓ | 1, 176 | 1, 306⅔ | 1, 437⅓ | 1, 568 |
| 30 x 30 | 750 | 900 | 1, 050 | 1, 200 | 1, 350 | 1, 500 | 1, 650 | 1, 800 |

| End dimensions, inches | Length of timber—feet | | | | | |
|---|---|---|---|---|---|---|
| | 28 | 32 | 34 | 36 | 38 | 40 |
| | Contents—board feet | | | | | |
| 8 x 8 | 149 1/3 | 170 2/3 | 181 1/3 | 192 | 202 2/3 | 213 1/3 |
| 10 | 186 2/3 | 213 1/3 | 226 2/3 | 240 | 253 1/3 | 266 2/3 |
| 12 | 224 | 256 | 272 | 288 | 304 | 320 |
| 14 | 261 1/3 | 298 2/3 | 317 1/3 | 336 | 354 2/3 | 373 1/3 |
| 10 x 10 | 233 1/3 | 266 2/3 | 283 1/3 | 300 | 316 2/3 | 333 1/3 |
| 12 | 280 | 320 | 340 | 360 | 380 | 400 |
| 14 | 326 2/3 | 373 1/3 | 396 2/3 | 420 | 443 1/3 | 466 2/3 |
| 16 | 373 1/3 | 426 2/3 | 453 1/3 | 480 | 506 2/3 | 533 1/3 |
| 12 x 12 | 336 | 384 | 408 | 432 | 456 | 480 |
| 14 | 392 | 448 | 476 | 504 | 532 | 560 |
| 16 | 448 | 512 | 544 | 576 | 608 | 640 |
| 14 x 14 | 457 1/3 | 522 2/3 | 555 1/3 | 588 | 620 2/3 | 653 1/3 |
| 16 | 522 2/3 | 597 1/3 | 634 2/3 | 672 | 709 1/3 | 746 2/3 |
| 18 | 588 | 672 | 714 | 756 | 798 | 840 |
| 16 x 16 | 597 1/3 | 682 2/3 | 725 1/3 | 768 | 810 2/3 | 853 1/3 |
| 18 | 672 | 768 | 816 | 864 | 912 | 960 |
| 20 | 746 2/3 | 853 1/3 | 906 2/3 | 960 | 1,013 1/3 | 1,066 2/3 |
| 18 x 18 | 756 | 864 | 918 | 972 | 1,026 | 1,080 |
| 20 x 20 | 933 1/3 | 1,066 2/3 | 1,133 1/3 | 1,200 | 1,266 2/3 | 1,333 1/3 |
| 22 x 22 | 1,129 1/3 | 1,290 2/3 | 1,371 1/3 | 1,452 | 1,532 2/3 | 1,613 1/3 |
| 24 x 24 | 1,344 | 1,536 | 1,632 | 1,728 | 1,824 | 1,920 |
| 26 x 26 | 1,577 1/3 | 1,802 2/3 | 1,915 1/3 | 2,028 | 2,140 2/3 | 2,253 1/3 |
| 28 x 28 | 1,829 1/3 | 2,090 2/3 | 2,221 1/3 | 2,352 | 2,482 2/3 | 2,613 1/3 |
| 30 x 30 | 2,100 | 2,400 | 2,550 | 2,700 | 2,850 | 3,000 |

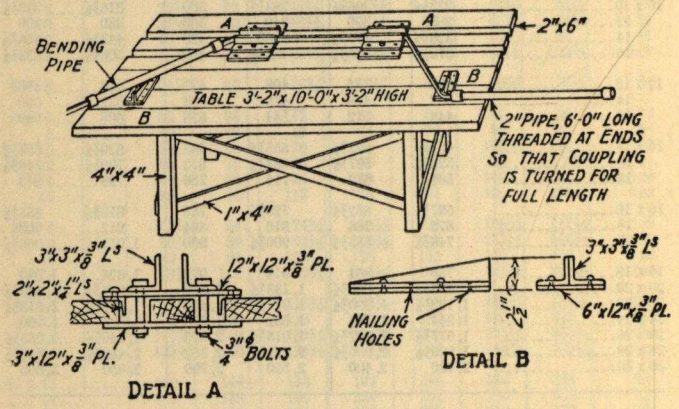



Device for Bending Light Bars for Hoops and Stirrups

## Bending Reinforcing Steel

Reinforcing bars up to 1⅛ inch size can be bent cold by hand. Above this size it will be convenient to use a power bender or to heat the bars before bending, but the heat should never be more than a dull red.

The most simple device for bending bars is shown here. This consists of a heavy table with legs preferably sunk




into the ground to insure rigidity. The two plates "A" are adjusted to the proper position by means of bolts and the two plates "B" are spiked to the table in the proper position. In bending, a long heavy pipe is slipped over the end of the bar to secure the necessary leverage. When the blocks are set for a certain size of bend, all bars in the building of these dimensions should be bent and the location of the bars indicated by paint marks and suitable tags.

Bending hoops for column reinforcement and stirrups for beams and girders is accomplished as shown on the preceding page. The steel is usually ¼ inch and is easily bent. Bars are cut to length and a small pipe slipped over the end of each to provide leverage as shown. © U. A. C. Co.

## Guy Ropes and Clips Required for Hoist Towers

| Height of guys from ground ft | Length of rope for 4 guys at 45° ft | HEIGHTS OF TOWERS AND LENGTHS OF GUYS IN FEET<br>20 ft has been added to each guy rope for anchorage | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 | 160 | 180 | 200 |
| 30 | 250 | .... | 250 | .... | .... | .... | 250 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 40 | 310 | 310 | .... | 310 | 310 | 310 | .... | 310 | 310 | 310 | 310 | 310 | 310 | 310 | 310 | 310 |
| 50 | 365 | .... | 365 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 60 | 420 | .... | .... | 420 | .... | .... | 420 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 70 | 480 | .... | .... | .... | 480 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 80 | 535 | .... | .... | .... | .... | 535 | .... | 535 | 535 | 535 | 535 | 535 | 535 | 535 | 535 | 535 |
| 90 | 590 | .... | .... | .... | .... | .... | 590 | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 100 | 650 | .... | .... | .... | .... | .... | .... | 650 | .... | .... | .... | .... | .... | .... | .... | .... |
| 110 | 705 | .... | .... | .... | .... | .... | .... | .... | 705 | .... | 705 | .... | .... | .... | .... | .... |
| 120 | 760 | .... | .... | .... | .... | .... | .... | .... | .... | 760 | .... | 760 | 760 | 760 | 760 | 760 |
| 130 | 815 | .... | .... | .... | .... | .... | .... | .... | .... | .... | 815 | .... | .... | .... | .... | .... |
| 140 | 875 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 875 | .... | .... | .... | .... |
| 150 | 930 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 930 | .... | .... | .... |
| 160 | 985 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 985 | 985 | 985 |
| 170 | 1045 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 180 | 1100 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1100 | .... |
| 190 | 1155 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... |
| 200 | 1215 | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | .... | 1215 |
| Total lin ft of guy rope required | | 310 | 615 | 730 | 790 | 845 | 1260 | 1495 | 1550 | 1605 | 2365 | 2480 | 2535 | 2590 | 3690 | 3805 |
| No. clips required (6 clips per guy) | | 24 | 48 | 48 | 48 | 48 | 72 | 72 | 72 | 72 | 96 | 96 | 96 | 96 | 120 | 120 |

For guying towers: Use $\frac{5}{8}$″ C.C.S. wire rope for all towers carrying boom plants.
Use $\frac{5}{8}$″ C.C.S. wire rope for all towers over 70′ in height carrying continuous line chutes.
Use $\frac{1}{2}$″ C.C.S. wire rope for towers under 70′ in height carrying continuous line chutes.

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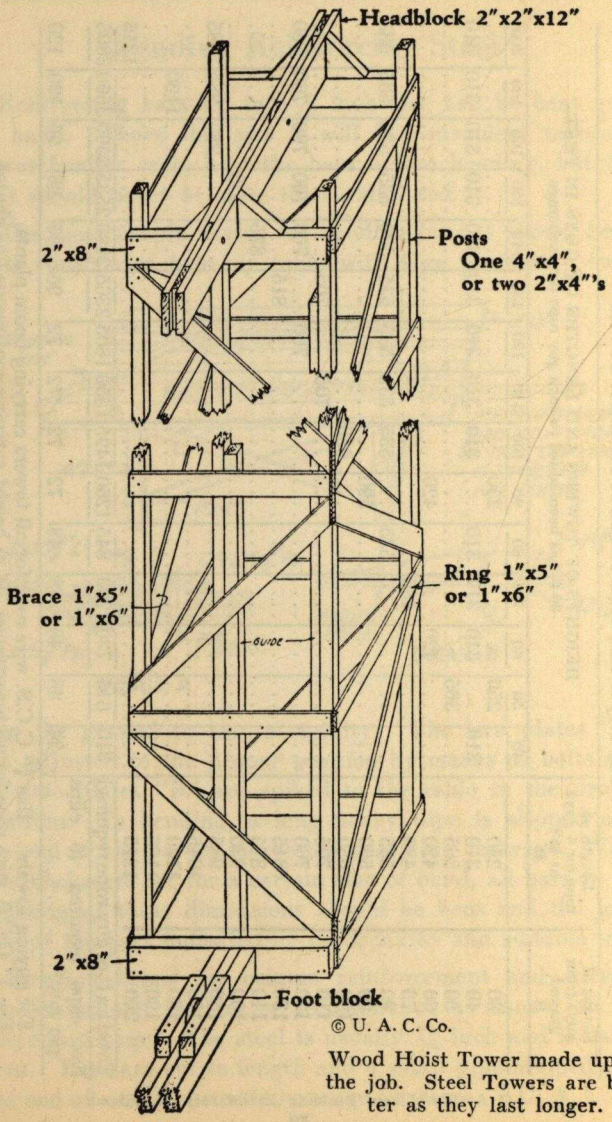


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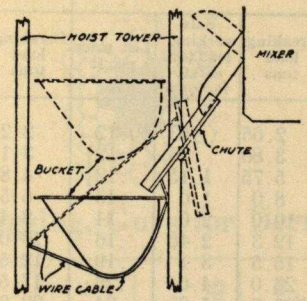
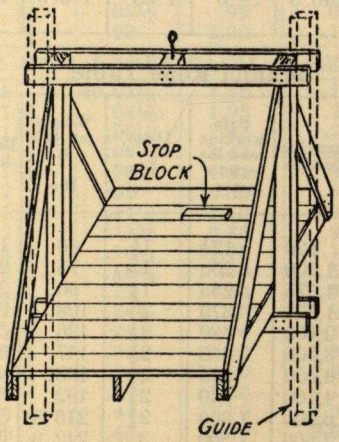
Wood Hoist Tower made up on the job. Steel Towers are better as they last longer.




Automatic Chute for discharging mixer into hoist bucket. When bucket descends it strikes the rope, pulling the chute into discharging position. When bucket ascends it pushes the chute back out of the way.




Platform Hoist for Wheelbarrow

© U. A. C. Co.

## Wire Rope Table

| Diam of rope, in | Weight per ft lbs | 6x19 Plow Steel | | | 6x19 Crucible Cast Steel | | |
|---|---|---|---|---|---|---|---|
| | | Breaking load tons | Safe working load tons safety factor 5 | List price per ft | Breaking load tons | Safe working load tons safety factor 5 | List price per ft |
| 1/4 | .10 | 2.65 | .53 | $0.12 | 2.2 | .44 | $0.09 |
| 5/16 | .15 | 3.80 | .76 | .12¼ | 3.1 | .62 | 09¼ |
| 3/8 | .22 | 5.75 | 1.15 | .12½ | 4.8 | .96 | .09½ |
| 7/16 | .30 | 8.0 | 1.6 | .13 | 6.5 | 1.3 | .10 |
| 1/2 | .39 | 10.0 | 2.0 | .14 | 8.4 | 1.68 | .11 |
| 9/16 | .50 | 12.3 | 2.46 | .16 | 10.0 | 2.0 | .12 |
| 5/8 | .62 | 15.5 | 3.1 | .19 | 12.5 | 2.5 | .14 |
| 3/4 | .89 | 23.0 | 4.6 | .26 | 17.5 | 3.5 | .19 |
| 7/8 | 1.20 | 29.0 | 5.8 | .34 | 23.0 | 4.6 | .24 |
| 1 | 1.58 | 38.0 | 7.6 | .43 | 30.0 | 6.0 | .31 |
| 1 1/8 | 2.00 | 47.0 | 9.4 | .54 | 38.0 | 7.6 | 38 |
| 1 1/4 | 2.45 | 58.0 | 11.6 | .65 | 47.0 | 9.4 | 46 |
| 1 3/8 | 3.00 | 72.0 | 14.4 | .79 | 56.0 | 11.2 | .56 |
| 1 1/2 | 3.55 | 82.0 | 16.4 | .93 | 64.0 | 12.8 | .66 |
| 1 5/8 | 4.15 | 94.0 | 18.8 | 1.08 | 72.0 | 14.4 | .77 |
| 1 3/4 | 4.85 | 112.0 | 22.4 | 1.30 | 85.0 | 17.0 | .90 |
| 1 7/8 | 5.55 | 127.0 | 25.4 | 1.46 | 96.0 | 19.2 | 1.02 |
| 2 | 6.30 | 140.0 | 28.0 | 1.58 | 106.0 | 21.2 | 1.16 |

## Manila Rope Table

| Diam, in | Weight per 100 ft lbs | Breaking load lbs | Safe working load lbs safety factor 5 | Diam, in | Weight per 100 ft lbs | Breaking load lbs | Safe working load lbs safety factor 5 |
|---|---|---|---|---|---|---|---|
| 1/4 | 1.83 | 620 | 124 | 1 1/2 | 60. | 17,000 | 3,400 |
| 5/16 | 2.42 | 1,000 | 200 | 1 5/8 | 75. | 20,000 | 4,000 |
| 3/8 | 3.67 | 1,275 | 255 | 1 3/4 | 90. | 25,000 | 5,000 |
| 7/16 | 5.42 | 1,875 | 375 | 2 | 108. | 30,000 | 6,000 |
| 1/2 | 7.5 | 2,400 | 480 | 2 1/8 | 126. | 33,000 | 6,600 |
| 9/16 | 10.42 | 3,300 | 660 | 2 1/4 | 147. | 37,000 | 7,400 |
| 5/8 | 13.33 | 4,000 | 800 | 2 3/8 | 168. | 43,000 | 8,600 |
| 3/4 | 16.5 | 4,700 | 940 | 2 5/8 | 192. | 50,000 | 10,000 |
| 7/8 | 22.5 | 6,500 | 1,300 | 2 7/8 | 215.8 | 56,000 | 11,200 |
| 1 | 27. | 7,500 | 1,500 | 3 | 242.9 | 62,000 | 12,400 |
| 1 1/8 | 36. | 10,500 | 2,100 | 3 1/8 | 270. | 68,000 | 13,600 |
| 1 1/4 | 42. | 12,500 | 2,500 | 3 1/4 | 300. | 75,000 | 15,000 |
| 1 3/8 | 54. | 15,400 | 3,080 | | | | |

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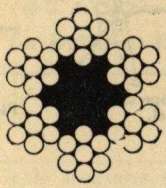
# Galvanized Iron Wire Rope



## For Ships' Rigging, Guys for Derricks, Etc.

| Diameter in Inches | Approximate Circumference in Inches | List Price Per Foot | Breaking Strength in Tons of 2000 Pounds | Approximate Weight Per Foot | Circumference of Equal Strength Manila Rope |
|---|---|---|---|---|---|
| **5 STRANDS OF 7 WIRES EACH—1 HEMP CENTER** | | | | | |
| 3/16 | 5/8 | $0.02 | .61 | .040 | 1 1/8 |
| 7/32 | 11/16 | .02 1/4 | .79 | .063 | 1 1/4 |
| 1/4 | 3/4 | .02 1/2 | .99 | .090 | 1 1/2 |
| 9/32 | 7/8 | .03 | 1.20 | .125 | 1 3/4 |
| **6 STRANDS OF 7 WIRES EACH—1 HEMP CENTER** | | | | | |
| 5/16 | 1 | $0.03 1/2 | 1.36 | .15 | 2 |
| 3/8 | 1 1/8 | .04 1/2 | 1.95 | .21 | 2 1/4 |
| 7/16 | 1 3/8 | .05 1/4 | 2.64 | .29 | 2 1/2 |
| 1/2 | 1 5/8 | .06 1/2 | 3.43 | .38 | 3 |
| 9/16 | 1 3/4 | .08 | 4.32 | .48 | 3 3/4 |
| 5/8 | 2 | .09 | 5.30 | .59 | 4 1/2 |
| 3/4 | 2 3/8 | .11 1/4 | 7.10 | .84 | 4 3/4 |
| 13/16 | 2 1/2 | .13 3/4 | 8.86 | .99 | 5 |
| 7/8 | 2 3/4 | .16 1/4 | 10.20 | 1.15 | 5 1/4 |
| 1 | 3 1/8 | .18 3/4 | 13.20 | 1.50 | 5 3/4 |
| 1 1/16 | 3 3/8 | .22 | 14.80 | 1.70 | 6 |
| 1 1/8 | 3 1/2 | .24 1/2 | 16.50 | 1.90 | 6 1/2 |
| 1 3/16 | 3 3/4 | .28 | 18.10 | 2.12 | 7 1/2 |
| 1 1/4 | 3 7/8 | .31 | 19.90 | 2.34 | 8 |
| 1 3/8 | 4 3/8 | .35 | 23.70 | 2.84 | 8 1/2 |
| 1 7/16 | 4 1/2 | .39 | 25.60 | 3.10 | 9 |
| 1 1/2 | 4 3/4 | .44 | 27.70 | 3.38 | 9 1/2 |
| 1 5/8 | 5 1/8 | .48 | 32.40 | 3.96 | 10 |
| 1 11/16 | 5 1/4 | .51 | 34.70 | 4.27 | 10 1/2 |
| 1 3/4 | 5 1/2 | .55 | 37 | 4.60 | 11 |

—From A. Leschen & Sons Rope Co. Handbook

## *Handling Wire Rope Properly*

Fig. 1. This is how wire rope should be taken from a reel.

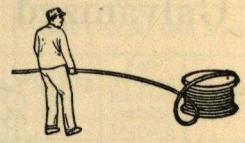


Fig. 2. The wrong way to take rope from a reel.

Fig. 3. The right way to uncoil wire rope.

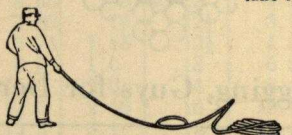


Fig. 4. Never uncoil wire rope in this manner.

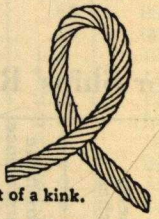


Fig. 5. The start of a kink.

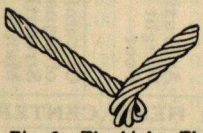


Fig. 6. The kink. The damage is done.

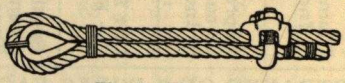


Fig. 8. The start.

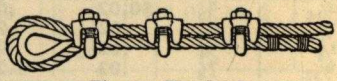


Fig. 9. The finish. How to apply wire rope clips.

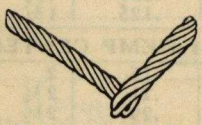


Fig. 7. Kink pulled tighter.

Fig. 10. Rope open ready to cut out hemp core.

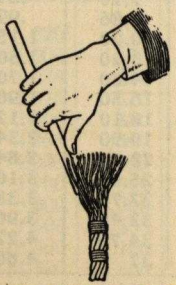
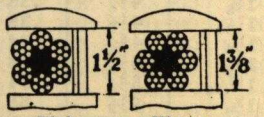


Fig. 11. Separating the wires.

Fig. 12. Ready for socket.

Fig. 13. Ready for spelter.




Right. Wrong.
Fig. 14. Way to measure wire rope.

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# Concrete Tables

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## Classes of Concrete for Different Degrees of Exposure

| Type of Structure | Degree of Exposure | U. S. Gal. of Water* per Sack of Cement |
|---|---|---|
| Walls, dams, piers and other structures exposed to sea or alkali waters. | Extreme | 5½ |
| Walls, dams, piers, reservoir linings, etc., exposed to alternate wetting and drying in fresh water in northern climate. Watertight structures. Sewers, pressure pipe, tanks, piles, athletic stadia, pavements, all thin structural members exposed to severe weather and frost action. | Severe | 6 |
| Walls, dams, piers, reservoir linings exposed to fresh water in southern climate. Exterior columns and beams of reinforced concrete buildings. Basement walls. Thin structural members of all types exposed to moderate weather and frost action. | Moderate | 6¾ |
| Ordinary enclosed structural members. Heavy piers and retaining walls in moderate exposure. Mass concrete, footings, etc., protected from alternate wetting and drying and from severe weather conditions. | Protected | 7½ |

*These quantities should not be exceeded even when resultant strength is higher than required for structural stability. Free water or moisture carried by the aggregate must be included as part of mixing water.

## Recommended Slumps for Concrete

| Type of Structure | Slump—Inches Minimum | Maximum |
|---|---|---|
| Massive sections, pavements and floors laid on ground | 1 | 4 |
| Heavy slabs, beams or walls | 3 | 6 |
| Thin walls and columns, ordinary slabs or beams | 4 | 8 |

## Approximate Quantity of Surface Water Carried by Average Aggregates*

| | |
|---|---|
| Very wet sand | ¾ to 1 gal. per cu. ft. |
| Moderately wet sand | about ½ gal. per cu. ft. |
| Moist sand | about ¼ gal. per cu. ft. |
| Moist gravel or crusht rock | about ¼ gal. per cu. ft. |

*The coarser the aggregate, the less free water it will carry.

### Approximate Absorption of Aggregates

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Average sand.....1.0 per cent by weight
Pebbles and crusht limestone....1.0 per cent by weight
Trap rock and granite.....0.5 per cent by weight
Porous sandstone.....7.0 per cent by weight
Very light and porous aggregate may be as high as 25 per cent by weight.

## COVERING CAPACITY OF MORTAR AND STUCCO

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### Area Covered by One Barrel of Cement in Various Mixes

| MIX Parts by Volume | | THICKNESS OF COAT | | | | |
|---|---|---|---|---|---|---|
| | | ¼ Inch | ⅜ Inch | ½ Inch | ¾ Inch | 1 Inch |
| Cement | Sand | Sq. Ft. | Sq. Ft. | Sq. Ft. | Sq. Ft. | Sq. Ft. |
| 1 | 1 | 266 | 177 | 133 | 89 | 66 |
| 1 | 1½ | 336 | 226 | 168 | 112 | 84 |
| 1 | 2 | 404 | 270 | 202 | 135 | 101 |
| 1 | 2½ | 472 | 314 | 236 | 157 | 118 |
| *1 | 3 | 542 | 362 | 271 | 181 | 136 |
| 1 | 3½ | 612 | 408 | 306 | 204 | 153 |
| 1 | 4 | 682 | 455 | 341 | 227 | 171 |

### Area Covered by One Cubic Yard of Sand in Various Mixes

| MIX Parts by Volume | | THICKNESS OF COAT | | | | |
|---|---|---|---|---|---|---|
| | | ¼ Inch | ⅜ Inch | ½ Inch | ¾ Inch | 1 Inch |
| Cement | Sand | Sq. Ft. | Sq. Ft. | Sq. Ft. | Sq. Ft. | Sq. Ft. |
| 1 | 1 | 1800 | 1200 | 900 | 600 | 450 |
| 1 | 1½ | 1508 | 1006 | 754 | 503 | 377 |
| 1 | 2 | 1364 | 910 | 682 | 455 | 341 |
| 1 | 2½ | 1282 | 855 | 641 | 427 | 321 |
| *1 | 3 | 1222 | 815 | 611 | 407 | 306 |
| 1 | 3½ | 1178 | 785 | 589 | 393 | 294 |
| 1 | 4 | 1148 | 765 | 574 | 383 | 287 |

*1:3 is the mix most used for stucco work.

Note:—The above areas are calculated for average sand and with no allowance for waste. In estimating, allowance should be made for waste. When figured for stucco, the loss of mortar in forming the keys behind the lath for the first coat should be taken into account.

## Quantities of Cement and Sand Needed for One Cubic Yard of Mortar

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| PROPORTIONS BY PARTS | | Barrels of Cement | Cubic Yards of Sand |
|---|---|---|---|
| Cement | Sand | | |
| 1 | 0 | 8.31 | |
| 1 | 1 | 4.88 | 0.72 |
| 1 | 1½ | 3.87 | 0.86 |
| 1 | 2 | 3.21 | 0.95 |
| 1 | 2½ | 2.74 | 1.01 |
| 1 | 3 | 2.39 | 1.06 |
| 1 | 4 | 1.90 | 1.13 |

## *QUANTITIES OF MORTAR, CEMENT AND SAND FOR LAYING 1000 BRICK

© U. A. C. Co.

| Width of Joint Inches | Cu. Ft. of Mortar | 1:2 Mortar | | 1:2½ Mortar | | 1:3 Mortar | | 1:3½ Mortar | |
|---|---|---|---|---|---|---|---|---|---|
| | | Cement Bbls. | Sand Cu. Yds. | Cement Bbls. | Sand Cu. Yds. | Cement Bbls. | Sand Cu. Yds. | Cement Bbls. | Sand Cu. Yds. |
| ¼ | 10 | 1.2 | 0.35 | 1.0 | 0.37 | 0.9 | 0.39 | 0.8 | 0.41 |
| ⅜ | 15 | 1.8 | 0.53 | 1.5 | 0.56 | 1.3 | 0.59 | 1.2 | 0.61 |
| ½ | 18 | 2.1 | 0.63 | 1.8 | 0.67 | 1.6 | 0.71 | 1.4 | 0.73 |
| ⅝ | 22 | 2.6 | 0.77 | 2.2 | 0.82 | 1.9 | 0.86 | 1.7 | 0.90 |

*Note:—In using this table, bear in mind that quantities for brick work are only approximate, because there is sure to be considerable variation in thickness of joints and in the size of brick.

## CONCRETE BUILDING BLOCK AND CLAY TILE

| | Cement for Laying 1000 1:3 Mortar | Sand for Laying 1000 1:3 Mortar | Number of Block to 100 Sq. Ft. of Wall Surface |
|---|---|---|---|
| Concrete Block 8 x 8 x 16 | 4.1 bbls. | 1.75 cu. yds. | 112 |
| Clay Tile† 3, 4, or 6 in. Partition | 2.3 bbls. | 1.03 cu. yds. | |
| Clay Tile†—Load Bearing: | | | |
| 6 x 12 x 12 | 2.9 bbls. | 1.29 cu. yds. | 100 |
| 8 x 12 x 12 | 3.5 bbls. | 1.55 cu. yds. | 100 |
| 12 x 12 x 12 | 4.6 bbls. | 2.06 cu. yds. | 100 |

†This information on Clay Tile was furnished by The Hollow Building Tile Association.

## QUANTITIES OF MATERIAL FOR CONCRETE

### Materials for One Cubic Yard of Rammed Concrete Based on Using Pebbles or Crusht Stone with Dust Removed

| Mixture | Bbls. Cement (4 sacks per bbl.) | Cu. Yds. Sand | Cu. Yds. Pebbles or Stone |
|---|---|---|---|
| 1:1½:2½ | 2.09 | 0.46 | 0.77 |
| 1:1½:3 | 1.91 | 0.42 | 0.85 |
| 1:2:3 | 1.74 | 0.52 | 0.77 |
| 1:2:3½ | 1.61 | 0.48 | 0.83 |
| 1:2:4 | 1.51 | 0.45 | 0.89 |
| 1:2½:4 | 1.39 | 0.51 | 0.82 |
| 1:2½:5 | 1.24 | 0.46 | 0.92 |
| 1:3:5 | 1.16 | 0.52 | 0.86 |
| 1:3:5½ | 1.11 | 0.49 | 0.90 |
| 1:3:6 | 1.06 | 0.47 | 0.94 |

(From Taylor & Thompson's "Concrete, Plain and Reinforced."

### Average Weights of Aggregates Used for Concrete

Size 1½ inches down to ¼ inch—dust screened out.

| | Pounds per Cubic Yard |
|---|---|
| Sand | 2430-2565 |
| Pebbles | 2800 |
| Limestone | 2400 |
| Granite | 2500 |
| Trap Rock | 2700 |

### Average Weight per Cubic Foot of Concrete in Place

| | Pounds per Cubic Foot |
|---|---|
| Gravel Concrete | 150 |
| Limestone Concrete | 150 |
| Trap Rock Concrete | 155 |
| Cinder Concrete | 112 |

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# NUMBER OF U. S. GALL IN RECTANGULAR TANKS

## For One Ft in Depth

| Width of Tank | Length of Tank | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ft 2 | ft in 2 6 | ft 3 | ft in 3 6 | ft 4 | ft in 4 6 | ft 5 | ft in 5 6 | ft 6 | ft in 6 6 | ft 7 | ft in 7 6 | ft 8 | ft in 8 6 | ft 9 | ft in 9 6 | ft 10 | ft in 10 6 | ft 11 | ft in 11 6 | ft 12 |
| Ft In | | | | | | | | | | | | | | | | | | | | | |
| 2 | 29.82 | 37.40 | 44.88 | 52.36 | 59.84 | 67.32 | 74 81 | 82.29 | 89.77 | 97.25 | 104.73 | 112.21 | 119.69 | 127.17 | 134.65 | 142.13 | 149.61 | 157.09 | 164.57 | 172.05 | 179.53 |
| 2 6 | ..... | 46.75 | 56.10 | 65.45 | 74.80 | 84.16 | 93.51 | 102.86 | 112.21 | 121.56 | 130.91 | 140.26 | 149.61 | 158.96 | 168.31 | 177.66 | 187.01 | 196.36 | 205.71 | 215.06 | 224.41 |
| 3 | ..... | ..... | 67.32 | 78.54 | 89.77 | 100.99 | 112.21 | 123 43 | 134.65 | 145.87 | 157.09 | 168.31 | 179.53 | 190.75 | 202.97 | 213.19 | 224.41 | 235.63 | 245.86 | 258.07 | 269.30 |
| 3 6 | ..... | ..... | ..... | 91.64 | 104.73 | 117.82 | 130.91 | 144.00 | 157.09 | 170.18 | 183.27 | 196.36 | 209.45 | 222.54 | 235.63 | 248.73 | 261.82 | 274.90 | 288.00 | 301.09 | 314.18 |
| 4 | ..... | ..... | ..... | ..... | 119.69 | 134.65 | 149.61 | 164.57 | 179.53 | 194.49 | 209.45 | 224.41 | 239.37 | 254.34 | 269.30 | 284.26 | 299.22 | 314.18 | 329.14 | 344.10 | 359.06 |
| 4 6 | ..... | ..... | ..... | ..... | ..... | 151.48 | 168.31 | 185.14 | 201.97 | 218.80 | 235.63 | 252.47 | 269.30 | 286.13 | 302.96 | 319.79 | 336.62 | 353.45 | 370.28 | 387.11 | 403.94 |
| 5 | ..... | ..... | ..... | ..... | ..... | ..... | 187.01 | 205.71 | 224.41 | 243.11 | 261.82 | 280.52 | 299.22 | 317.92 | 336.62 | 355.32 | 374.03 | 392.72 | 411.43 | 430 13 | 448.83 |
| 5 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 226.28 | 246.86 | 267.43 | 288.00 | 308.57 | 329.14 | 349.71 | 370.28 | 390.85 | 411.43 | 432.00 | 452.57 | 473.14 | 493.71 |
| 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 269.30 | 291.74 | 314.18 | 336.62 | 359.06 | 381.50 | 403.94 | 426.39 | 448.83 | 471.27 | 493.71 | 516.15 | 538.59 |
| 6 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 316.05 | 340.36 | 364.67 | 388.98 | 413.30 | 437.60 | 461.92 | 486.23 | 510.54 | 534.85 | 559.16 | 583.47 |
| 7 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 366.54 | 392.72 | 418.91 | 445.09 | 471.27 | 497.45 | 523.64 | 549.81 | 575.99 | 602.18 | 628.36 |
| 7 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 420.78 | 448.83 | 476.88 | 504.93 | 532.98 | 561.04 | 589.08 | 617.14 | 645.19 | 673.24 |
| 8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 478.75 | 508.67 | 538.59 | 568.51 | 598.44 | 628.36 | 658.28 | 688.20 | 718.12 |
| 8 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 540.46 | 572.25 | 604.05 | 635.84 | 667.63 | 699.42 | 731.21 | 763.00 |
| 9 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 605.92 | 639.58 | 673.25 | 706.90 | 740.56 | 774.23 | 807.89 |
| 9 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 675.11 | 710.65 | 746.17 | 781.71 | 817.24 | 852.77 |
| 10 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 748.05 | 785.45 | 822.86 | 860.26 | 897.66 |
| 10 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 824.73 | 864.00 | 903.26 | 942.56 |
| 11 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 905.14 | 946.27 | 987.43 |
| 11 6 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 989.29 | 1032.3 |
| 12 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1077.2 |

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MARION MALLEABLE IRON WORKS

| Concrete with 2½ inch Stone. | | | | | | Concrete with Gravel ¾ inch and under | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Proportions of Mixture | | | Req'd for 1 cy | | | Proportions of Mixture | | | Req'd for 1 cy | | |
| Cement | Sand | Stone | Cement Bbls | Sand cy | Stone cy | Cement | Sand | Gravel | Cement Bbls | Sand cy | Gravel cy |
| 1 | 1 | 2.0 | 2.72 | 0.41 | 0.83 | 1 | 1 | 2.5 | 2.10 | 0.32 | 0.80 |
| 1 | 1 | 2.5 | 2.41 | 0.37 | 0.92 | 1 | 1 | 3.0 | 1.89 | 0.29 | 0.86 |
| 1 | 1 | 3.0 | 2.16 | 0.33 | 0.98 | 1 | 1 | 3.5 | 1.71 | 0.26 | 0.91 |
| .... | .... | .... | .... | .... | .... | 1 | 1 | 4.0 | 1.55 | 0.24 | 0.94 |
| 1 | 1.5 | 2.5 | 2.16 | 0.49 | 0.82 | 1 | 1.5 | 3.0 | 1.71 | 0.39 | 0.78 |
| 1 | 1.5 | 3.0 | 1.96 | 0.45 | 0.89 | 1 | 1.5 | 3.5 | 1.57 | 0.36 | 0.83 |
| 1 | 1.5 | 3.5 | 1.79 | 0.41 | 0.96 | 1 | 1.5 | 4.0 | 1.46 | 0.33 | 0.88 |
| 1 | 1.5 | 4.0 | 1.64 | 0.38 | 1.00 | 1 | 1.5 | 4.5 | 1.34 | 0.31 | 0.91 |
| .... | .... | .... | .... | .... | .... | 1 | 1.5 | 5.0 | 1.24 | 0.28 | 0.94 |
| 1 | 2.0 | 3.0 | 1.78 | 0.54 | 0.81 | 1 | 2.0 | 3.5 | 1.44 | 0.44 | 0.77 |
| 1 | 2.0 | 3.5 | 1.66 | 0.50 | 0.88 | 1 | 2.0 | 4.0 | 1.34 | 0.41 | 0.81 |
| 1 | 2.0 | 4.0 | 1.53 | 0.47 | 0.93 | 1 | 2.0 | 4.5 | 1.26 | 0.38 | 0.86 |
| 1 | 2.0 | 4.5 | 1.43 | 0.43 | 0.98 | 1 | 2.0 | 5.0 | 1.17 | 0.36 | 0.89 |
| .... | .... | .... | .... | .... | .... | 1 | 2.0 | 6.0 | 1.03 | 0.31 | 0.94 |
| 1 | 2.5 | 3.5 | 1.51 | 0.58 | 0.81 | 1 | 2.5 | 4.0 | 1.24 | 0.47 | 0.75 |
| 1 | 2.5 | 4.0 | 1.42 | 0.54 | 0.87 | 1 | 2.5 | 4.5 | 1.16 | 0.44 | 0.80 |
| 1 | 2.5 | 4.5 | 1.33 | 0.51 | 0.91 | 1 | 2.5 | 5.0 | 1.10 | 0.42 | 0.83 |
| 1 | 2.5 | 5.0 | 1.26 | 0.48 | 0.96 | 1 | 2.5 | 5.5 | 1.03 | 0.39 | 0.86 |
| 1 | 2.5 | 5.5 | 1.18 | 0.44 | 0.99 | 1 | 2.5 | 6.0 | 0.98 | 0.37 | 0.89 |
| .... | .... | .... | .... | .... | .... | 1 | 2.5 | 7.0 | 0.88 | 0.33 | 0.93 |
| 1 | 3.0 | 4.0 | 1.32 | 0.60 | 0.80 | 1 | 3.0 | 5.0 | 1.03 | 0.47 | 0.78 |
| 1 | 3.0 | 4.5 | 1.24 | 0.57 | 0.85 | 1 | 3.0 | 5.5 | 0.97 | 0.44 | 0.81 |
| 1 | 3.0 | 5.0 | 1.17 | 0.54 | 0.89 | 1 | 3.0 | 6.0 | 0.92 | 0.42 | 0.84 |
| 1 | 3.0 | 5.5 | 1.11 | 0.51 | 0.93 | 1 | 3.0 | 6.5 | 0.88 | 0.40 | 0.87 |
| 1 | 3.0 | 6.0 | 1.06 | 0.48 | 0.97 | 1 | 3.0 | 7.0 | 0.84 | 0.38 | 0.89 |
| .... | .... | .... | .... | .... | .... | 1 | 3.0 | 7.5 | 0.80 | 0.37 | 0.91 |
| .... | .... | .... | .... | .... | .... | 1 | 3.0 | 8.0 | 0.76 | 0.35 | 0.93 |
| 1 | 3.5 | 5.0 | 1.11 | 0.59 | 0.85 | 1 | 3.5 | 6.0 | 0.88 | 0.46 | 0.80 |
| 1 | 3.5 | 5.5 | 1.06 | 0.56 | 0.89 | 1 | 3.5 | 6.5 | 0.83 | 0.44 | 0.82 |
| 1 | 3.5 | 6.0 | 1.00 | 0.53 | 0.92 | 1 | 3.5 | 7.0 | 0.80 | 0.43 | 0.85 |
| 1 | 3.5 | 6.5 | 0.96 | 0.51 | 0.95 | 1 | 3.5 | 7.5 | 0.76 | 0.41 | 0.87 |
| 1 | 3.5 | 7.0 | 0.91 | 0.49 | 0.98 | 1 | 3.5 | 8.0 | 0.73 | 0.39 | 0.89 |
| .... | .... | .... | .... | .... | .... | 1 | 3.5 | 8.5 | 0.71 | 0.38 | 0.91 |
| .... | .... | .... | .... | .... | .... | 1 | 3.5 | 9.0 | 0.68 | 0.36 | 0.92 |
| 1 | 4.0 | 6.0 | 0.95 | 0.58 | 0.87 | 1 | 4.0 | 7.0 | 0.77 | 0.47 | 0.81 |
| 1 | 4.0 | 6.5 | 0.91 | 0.55 | 0.90 | 1 | 4.0 | 7.5 | 0.73 | 0.44 | 0.83 |
| 1 | 4.0 | 7.0 | 0.87 | 0.53 | 0.93 | 1 | 4.0 | 8.0 | 0.71 | 0.43 | 0.86 |
| 1 | 4.0 | 7.5 | 0.84 | 0.51 | 0.96 | 1 | 4.0 | 8.5 | 0.68 | 0.42 | 0.88 |
| 1 | 4.0 | 8.0 | 0.81 | 0.49 | 0.98 | 1 | 4.0 | 9.0 | 0.65 | 0.40 | 0.89 |
| .... | .... | .... | .... | .... | .... | 1 | 4.0 | 9.5 | 0.63 | 0.38 | 0.91 |
| .... | .... | .... | .... | .... | .... | 1 | 4.0 | 10.0 | 0.61 | 0.37 | 0.93 |

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| Concrete with Stone 1 inch and under | | | | | | Concrete with Stone 2½ inch and under | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Proportions of Mixture | | | Req'd for 1 cy | | | Proportions of Mixture | | | Req'd for 1 cy | | |
| Cement | Sand | Stone | Cement Bbls | Sand cy | Stone cy | Cement | Sand | Stone | Cement Bbls | Sand cy | Stone cy |
| 1 | 1 | 2.0 | 2.57 | 0.39 | 0.78 | 1 | 1 | 2.0 | 2.63 | 0.40 | 0.80 |
| 1 | 1 | 2.5 | 2.29 | 0.35 | 0.70 | 1 | 1 | 2.5 | 2.34 | 0.36 | 0.89 |
| 1 | 1 | 3.0 | 2.06 | 0.31 | 0.94 | 1 | 1 | 3.0 | 2.10 | 0.32 | 0.96 |
| 1 | 1 | 3.5 | 1.84 | 0.28 | 0.98 | 1 | 1 | 3.5 | 1.88 | 0.29 | 1.00 |
| 1 | 1.5 | 2.5 | 2.05 | 0.47 | 0.78 | 1 | 1.5 | 2.5 | 2.09 | 0.48 | 0.80 |
| 1 | 1.5 | 3.0 | 1.85 | 0.42 | 0.84 | 1 | 1.5 | 3.0 | 1.90 | 0.43 | 0.87 |
| 1 | 1.5 | 3.5 | 1.72 | 0.39 | 0.91 | 1 | 1.5 | 3.5 | 1.74 | 0.40 | 0.93 |
| 1 | 1.5 | 4.0 | 1.57 | 0.36 | 0.96 | 1 | 1.5 | 4.0 | 1.61 | 0.37 | 0.98 |
| 1 | 1.5 | 4.5 | 1.43 | 0.33 | 0.98 | 1 | 1.5 | 4.5 | 1.46 | 0.33 | 1.00 |
| 1 | 2.0 | 3.0 | 1.70 | 0.52 | 0.77 | 1 | 2.0 | 3.0 | 1.73 | 0.53 | 0.79 |
| 1 | 2.0 | 3.5 | 1.57 | 0.48 | 0.83 | 1 | 2.0 | 3.5 | 1.61 | 0.49 | 0.85 |
| 1 | 2.0 | 4.0 | 1.46 | 0.44 | 0.89 | 1 | 2.0 | 4.0 | 1.48 | 0.45 | 0.90 |
| 1 | 2.0 | 4.5 | 1.36 | 0.42 | 0.93 | 1 | 2.0 | 4.5 | 1.38 | 0.42 | 0.95 |
| 1 | 2.0 | 5.0 | 1.27 | 0.39 | 0.97 | 1 | 2.0 | 5.0 | 1.29 | 0.39 | 0.98 |
| 1 | 2.5 | 3.5 | 1.45 | 0.55 | 0.77 | 1 | 2.5 | 3.5 | 1.48 | 0.56 | 0.79 |
| 1 | 2.5 | 4.0 | 1.35 | 0.52 | 0.82 | 1 | 2.5 | 4.0 | 1.38 | 0.53 | 0.84 |
| 1 | 2.5 | 4.5 | 1.27 | 0.48 | 0.87 | 1 | 2.5 | 4.5 | 1.29 | 0.49 | 0.88 |
| 1 | 2.5 | 5.0 | 1.19 | 0.46 | 0.91 | 1 | 2.5 | 5.0 | 1.21 | 0.46 | 0.92 |
| 1 | 2.5 | 5.5 | 1.13 | 0.43 | 0.94 | 1 | 2.5 | 5.5 | 1.15 | 0.44 | 0.96 |
| 1 | 2.5 | 6.0 | 1.07 | 0.41 | 0.97 | 1 | 2.5 | 6.0 | 1.07 | 0.41 | 0.98 |
| 1 | 3.0 | 4.0 | 1.26 | 0.58 | 0.77 | 1 | 3.0 | 4.0 | 1.28 | 0.58 | 0.78 |
| 1 | 3.0 | 4.5 | 1.18 | 0.54 | 0.81 | 1 | 3.0 | 4.5 | 1.20 | 0.55 | 0.82 |
| 1 | 3.0 | 5.0 | 1.11 | 0.51 | 0.85 | 1 | 3.0 | 5.0 | 1.14 | 0.52 | 0.87 |
| 1 | 3.0 | 5.5 | 1.06 | 0.48 | 0.89 | 1 | 3.0 | 5.5 | 1.07 | 0.49 | 0.90 |
| 1 | 3.0 | 6.0 | 1.01 | 0.46 | 0.92 | 1 | 3.0 | 6.0 | 1.02 | 0.47 | 0.93 |
| 1 | 3.0 | 6.5 | 0.96 | 0.44 | 0.95 | 1 | 3.0 | 6.5 | 0.98 | 0.44 | 0.96 |
| 1 | 3.0 | 7.0 | 0.91 | 0.42 | 0.97 | 1 | 3.0 | 7.0 | 0.92 | 0.42 | 0.98 |
| 1 | 3.0 | 5.0 | 1.05 | 0.56 | 0.80 | 1 | 3.5 | 5.0 | 1.07 | 0.57 | 0.82 |
| 1 | 3.5 | 5.5 | 1.00 | 0.53 | 0.84 | 1 | 3.5 | 5.5 | 1.02 | 0.54 | 0.85 |
| 1 | 3.5 | 6.0 | 0.95 | 0.50 | 0.87 | 1 | 3.5 | 6.0 | 0.97 | 0.51 | 0.89 |
| 1 | 3.5 | 6.5 | 0.92 | 0.49 | 0.91 | 1 | 3.5 | 6.5 | 0.93 | 0.49 | 0.92 |
| 1 | 3.5 | 7.0 | 0.87 | 0.47 | 0.93 | 1 | 3.5 | 7.0 | 0.89 | 0.47 | 0.95 |
| 1 | 3.5 | 7.5 | 0.84 | 0.45 | 0.96 | 1 | 3.5 | 7.5 | 0.85 | 0.45 | 0.98 |
| 1 | 3.5 | 8.0 | 0.80 | 0.42 | 0.97 | .... | .... | .... | .... | .... | .... |
| 1 | 4.0 | 6.0 | 0.90 | 0.55 | 0.82 | 1 | 4.0 | 6.0 | 0.92 | 0.56 | 0.84 |
| 1 | 4.0 | 6.5 | 0.87 | 0.53 | 0.85 | 1 | 4.0 | 6.5 | 0.88 | 0.53 | 0.87 |
| 1 | 4.0 | 7.0 | 0.83 | 0.51 | 0.89 | 1 | 4.0 | 7.0 | 0.84 | 0.51 | 0.90 |
| 1 | 4.0 | 7.5 | 0.80 | 0.49 | 0.91 | 1 | 4.0 | 7.5 | 0.81 | 0.50 | 0.93 |
| 1 | 4.0 | 8.0 | 0.77 | 0.47 | 0.93 | 1 | 4.0 | 8.0 | 0.78 | 0.48 | 0.95 |
| 1 | 4.0 | 8.5 | 0.74 | 0.45 | 0.95 | 1 | 4.0 | 8.5 | 0.76 | 0.46 | 0.98 |
| 1 | 4.0 | 9.0 | 0.71 | 0.43 | 0.97 | .... | .... | .... | .... | .... | .... |

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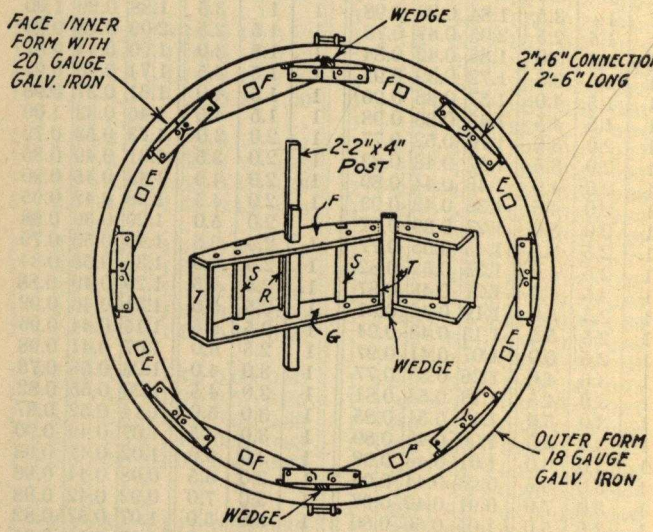
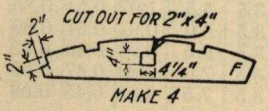
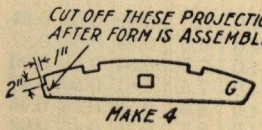
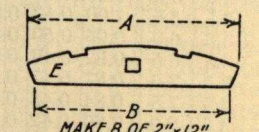
## Round Structures

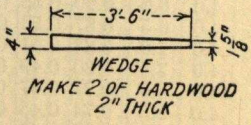
Marion Hex Couplings are extensively used for making circular reinforcement continuous. Marion Cable Clips are used to lap-joint circular steel. Marion Tank Lugs are used on wood silos, concrete stave silos and concrete block silos. The following pages are devoted to miscellaneous information on the design and construction of silos, tanks and round bins.

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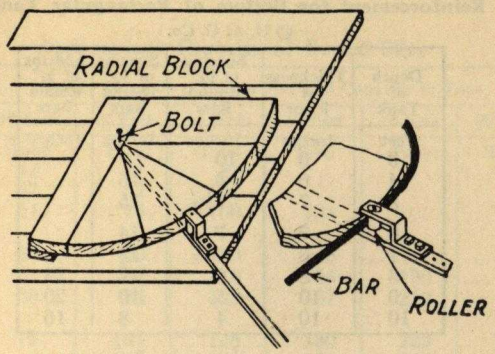
Details of Circular Form




## Bending Circular Steel

On large structures, horizontal steel is easily bent around the vertical rods. For smaller structures, steel must be bent to a circle. The device shown represents one good method. The radius of the block should be less than half the diameter of the hoop to allow for the spring in the steel. It is not necessary that the bend be absolutely accurate as the hoops can be sprung slightly to achieve their desired shape.

**Sizes and Quantities for Circular Forms of Various Diameters**

| INNER FORM | | | | | OUTER FORM |
|---|---|---|---|---|---|
| Inside Diam. | Number of Sections in Inner Form | Length A | Length B | 20-Gauge Gal. Steel 36 In. Wide, Length of Each Piece | 18-Gauge Gal. Steel 36 In. Wide, 2 Pcs. Length of Each Piece |
| 10 ft. | 6 | 5′- 0″ | 4′- 7½″ | 5′-2¾″ | 18′- 3″ |
| 12 ft. | 8 | 4′- 6¾″ | 4′- 1½″ | 4′-8½″ | 21′- 5″ |
| 14 ft. | 8 | 5′- 4″ | 4′-11½″ | 5′-6″ | 24′- 7″ |
| 16 ft. | 8 | 6′- 1″ | 5′- 9½″ | 6′-3″ | 27′- 9″ |
| 18 ft. | 8 | 6′-10½″ | 6′- 7½″ | 7′-0¾″ | 30′-10½″ |
| 20 ft. | 10 | 6′- 2″ | 5′-10″ | 6′-3″ | 34′- 0″ |

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## Reinforcement for Bottom of Rectangular Tanks

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| Depth of Tank | Thickness of Floor | Spacing of ⅜" Round Bars | Spacing of ½" Round Bars | Spacing of ¾" Round Bars |
|---|---|---|---|---|
| Feet | Inches | Inches | Inches | Inches |
| 3 | 6 | 10 | .. | .. |
| 4 | 6 | 8 | 16 | .. |
| 5 | 7 | 7½ | 15 | .. |
| 6 | 7 | 7 | 14 | .. |
| 7 | 8 | 6½ | 13 | .. |
| 8 | 8 | 6 | 12 | 24 |
| 9 | 10 | 5 | 10 | 20 |
| 10 | 10 | 4 | 8 | 16 |

## Size and Spacing of Bars in Walls of Rectangular Tanks

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| Depth of Tank | Thickness of Wall | Spacing of ⅜" Round Bars | | Spacing of ½" Round Bars | | Spacing of ¾" Round Bars | | Spacing of 1" Round Bars | |
|---|---|---|---|---|---|---|---|---|---|
| | | Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal | Vertical | Horizontal |
| Feet | Inches | Inches | Inches | Inches | Inches | Inches | Inches | Inches | Inches |
| 3 | 5 | 5 | 10 | 10 | 20 | ... | ... | ... | ... |
| 4 | 5 | 4 | 8 | 8 | 16 | 16 | 32 | ... | ... |
| 5 | 5½ | 3 | 6 | 6 | 12 | 12 | 24 | ... | ... |
| 6 | 6½ | 2½ | 5 | 5 | 10 | 10 | 20 | 18 | 36 |
| 7 | 8 | ... | ... | 3 | 6 | 7 | 14 | 16 | 30 |
| 8 | 9½ | ... | ... | 2½ | 5 | 5 | 10 | 11 | 22 |
| 9 | 10½ | ... | ... | ... | ... | 5 | 10 | 10 | 20 |
| 10 | 12 | ... | ... | ... | ... | 4 | 8 | 8 | 16 |

## Size and Spacing of Bars in Walls of Circular Tanks

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| (1) Depth | (2) Diameter | (3) Thickness of Concrete in Wall | (4) Diameter of Horizontal Bars | (5) Spacing Horizontal Bars at Bottom | (6) Spacing Horizontal Bars at Top | (7) Diameter Vertical Bars | (8) Spacing Vertical Bars |
|---|---|---|---|---|---|---|---|
| Feet | Feet | Inches | Inches | Inches | Inches | Inches | Inches |
| 5 | 5 | 6 | ¼ | 8 | 18 | ¼ | 36 |
| 5 | 10 | 6 | ¼ | 6 | 12 | ¼ | 30 |
| 10 | 10 | 8 | ⅜ | 6 | 18 | ⅜ | 36 |
| 10 | 15 | 9 | ⅜ | 4 | 18 | ⅜ | 36 |
| 15 | 10 | 10 | ⅜ | 4 | 18 | ⅜ | 30 |
| 15 | 15 | 12 | ½ | 6 | 20 | ⅜ | 30 |

## Approximate Capacity of Round Silos

| Height of Silo | Inside Diameter of Silo in Feet and Capacity in Tons | | | | | |
|---|---|---|---|---|---|---|
| | 10 Feet | 12 Feet | 14 Feet | 16 Feet | 18 Feet | 20 Feet |
| Feet | Tons | Tons | Tons | Tons | Tons | Tons |
| 28 | 42 | 61 | 83 | ..... | ..... | ..... |
| 30 | 47 | 67 | 91 | ..... | ..... | ..... |
| 32 | 51 | 74 | 100 | 131 | ..... | ..... |
| 34 | 56 | 80 | 109 | 143 | ..... | ..... |
| 36 | 61 | 87 | 118 | 155 | 196 | ..... |
| 38 | 66 | 94 | 128 | 167 | 212 | ..... |
| 40 | 70 | 101 | 138 | 180 | 229 | 280 |
| 42 | ..... | 109 | 148 | 193 | 244 | 299 |
| 44 | ..... | 117 | 159 | 207 | 261 | 320 |
| 46 | ..... | ..... | 170 | 222 | 277 | 340 |
| 48 | ..... | ..... | ..... | 236 | 293 | 361 |
| 50 | ..... | ..... | ..... | ..... | 310 | 382 |

## *Quantities for Concrete Silos—6-in. Walls 1:2:4 Walls and 1:2½:5 Floor and Footings; without Roof

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| Size Diameter x Height | Cement Bbls. | Sand Cu. Yds. | Stone or Pebbles Cu. Yds. | Size Diameter x Height | Cement Bbls. | Sand Cu. Yds. | Stone or Pebbles Cu. Yds. |
|---|---|---|---|---|---|---|---|
| 10 x 25 ft. | 25.0 | 7.5 | 15.0 | 14 x 40 ft. | 54.5 | 16.5 | 33.0 |
| 12 x 30 ft. | 36.0 | 11.0 | 22.0 | 16 x 40 ft. | 62.5 | 19.0 | 38.0 |
| 12 x 35 ft. | 41.0 | 12.5 | 25.0 | 16 x 45 ft. | 69.0 | 21.0 | 42.0 |
| 14 x 30 ft. | 42.5 | 13.0 | 26.0 | 18 x 45 ft. | 80.0 | 24.5 | 49.0 |
| 14 x 35 ft. | 48.0 | 14.7 | 29.4 | 18 x 50 ft. | 86.5 | 26.5 | 53.0 |

*These quantities are approximate.

## Material for 14-Foot Silo Form

5 pieces 2x12x16 feet, for ribs.
1 piece 2x12x 6 feet, for ribs.
4 pieces 2x 6x12 feet, for studding.
6 pieces 2x 4x12 feet, for studding.
4 pieces 2x 6x10 feet, for connections.
2 pieces 18 gauge galvanized steel 3 feet wide, 24 feet 7 inches long.
8 pieces 20 gauge galvanized steel 3 feet wide, 5 feet 6 inches long.
3 pieces 2x6x8 feet, for continuous door form.
2 pieces 2x2x8 feet, for continuous door form.
64 pieces ½x4½ in. carriage bolts.

## Spacing of Horizontal Reinforcing Bars for Silos of Various Inside Diameters

| Distance in feet down from top of Silo | 10-foot diameter | 12-foot diameter | 14-foot diameter | 16-foot diameter | 18-foot diameter | 20-foot diameter |
|---|---|---|---|---|---|---|
| | ⅜-inch Round Bars | ⅜-inch Round Bars | ½-inch Round Bars | ½-inch Round Bars | ½-inch Round Bars | ½-inch Round Bars |
| | Inches | Inches | Inches | Inches | Inches | Inches |
| Top 5 ft. | 24 | 24 | 24 | 24 | 24 | 24 |
| 5 to 10 | 24 | 24 | 24 | 24 | 24 | 24 |
| 10 to 15 | 24 | 18 | 24 | 24 | 24 | 24 |
| 15 to 20 | 18 | 16 | 24 | 18 | 18 | 16 |
| 20 to 25 | 16 | 12 | 18 | 16 | 14 | 14 |
| 25 to 30 | 14 | 10 | 16 | 14 | 12 | 12 |
| 30 to 35 | 12 | 9 | 14 | 12 | 10 | 10 |
| 35 to 40 | 10 | 8 | 12 | 10 | 9 | 8 |
| 40 to 45 | 9 | 7 | 11 | 9 | 8 | 7½ |
| 45 to 50 | 8 | 6½ | 10 | 8½ | 7½ | 7 |

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## Silo Data Generally Used

| Number of Cows in Herd | Feed for 180 Days | | | | Feed for 240 Days | | | |
|---|---|---|---|---|---|---|---|---|
| | Estimated Tonnage of Silage Consumed | Size of Silo | | Corn Acreage Required at 15 Tons to Acre | Estimated Tonnage of Silage Consumed | Size of Silo | | Corn Acreage Required at 15 Tons to Acre |
| | | Diameter | Height | | | Diameter | Height | |
| | Tons | Ft | Ft | Acres | Tons | Ft | Ft | Acres |
| 10..... | 36 | 10 | 25 | 2½ | 48 | 10 | 31 | 3½ |
| 12..... | 43 | 10 | 28 | 3 | 57 | 10 | 35 | 4 |
| 15..... | 54 | 11 | 29 | 4 | 72 | 11 | 36 | 5 |
| 20..... | 72 | 12 | 32 | 5 | 96 | 12 | 39 | 6½ |
| 25..... | 90 | 13 | 33 | 6 | 120 | 13 | 40 | 8 |
| 30..... | 108 | 14 | 34 | 7½ | 144 | 15 | 37 | 10 |
| 35..... | 126 | 15 | 34 | 8½ | 168 | 16 | 38 | 11 |
| 40..... | 144 | 16 | 35 | 10 | 192 | 17 | 39 | 13 |
| 45..... | 162 | 16 | 37 | 11 | 216 | 18 | 39 | 14½ |
| 50..... | 180 | 17 | 37 | 12 | 240 | 19 | 39 | 16 |
| 60..... | 216 | 18 | 39 | 14½ | 288 | 20 | 40 | 19 |
| 70..... | 252 | 19 | 40 | 17 | 336 | ..... | ..... | ..... |

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## U. S. GALL IN ROUND TANKS

For One Ft in Depth

| Diam of Tanks | No. U. S. Gall | CF and Area in SF | Diam of Tanks | No. U. S. Gall | CF and Area in SF | Diam of Tanks | No. U. S. Gall | CF and Area in SF |
|---|---|---|---|---|---|---|---|---|
| 1′ | 5.87 | .785 | 5′ 8″ | 188.66 | 25.22 | 19′ | 2120.90 | 283.53 |
| 1′ 1″ | 6.89 | .922 | 5′ 9″ | 194.25 | 25.97 | 19′ 3″ | 2177.10 | 291.04 |
| 1′ 2″ | 8. | 1.069 | 5′ 10″ | 199.92 | 26.73 | 19′ 6″ | 2234. | 298.65 |
| 1′ 3″ | 9.18 | 1.227 | 5′ 11″ | 205.67 | 27.49 | 19′ 9″ | 2291.70 | 306.35 |
| 1′ 4″ | 10.44 | 1.396 | 6′ | 211.51 | 28.27 | 20′ | 2350.10 | 314.16 |
| 1′ 5″ | 11.79 | 1.576 | 6′ 3″ | 229.50 | 30.68 | 20′ 3″ | 2409.20 | 322.06 |
| 1 6″ | 13.22 | 1.767 | 6′ 6″ | 248.23 | 33.18 | 20′ 6″ | 2469.10 | 330.06 |
| 1′ 7″ | 14.73 | 1.969 | 6′ 9″ | 267.69 | 35.78 | 20′ 9″ | 2529.60 | 338.16 |
| 1′ 8″ | 16.32 | 2.182 | 7′ | 287.88 | 38.48 | 21′ | 2591. | 346.36 |
| 1 9″ | 17.99 | 2.405 | 7′ 3″ | 308.81 | 41.28 | 21′ 3″ | 2653. | 354.66 |
| 1′ 10″ | 19.75 | 2.640 | 7′ 6″ | 330.48 | 44.18 | 21′ 6″ | 2715.80 | 363.05 |
| 1′ 11″ | 21.58 | 2.885 | 7′ 9″ | 352.88 | 47.17 | 21′ 9″ | 2779.30 | 371.54 |
| 2′ | 23.50 | 3.142 | 8′ | 376.01 | 50.27 | 22′ | 2843.60 | 380.13 |
| 2′ 1″ | 25.50 | 3.409 | 8′ 3″ | 399.88 | 53.46 | 22′ 3″ | 2908.60 | 388.82 |
| 2′ 2″ | 27.58 | 3.687 | 8′ 6″ | 424.48 | 56.75 | 22′ 6″ | 2974.30 | 397.61 |
| 2′ 3″ | 29.74 | 3.976 | 8′ 9″ | 449.82 | 60.13 | 22′ 9″ | 3040.80 | 406.49 |
| 2′ 4″ | 31.99 | 4.276 | 9′ | 475.89 | 63.62 | 23′ | 3108. | 415.48 |
| 2′ 5″ | 34.31 | 4.587 | 9′ 3″ | 502.70 | 67.20 | 23′ 3″ | 3175.90 | 424.56 |
| 2′ 6″ | 36.72 | 4.909 | 9′ 6″ | 530.24 | 70.88 | 23′ 6″ | 3244.60 | 433.74 |
| 2′ 7″ | 39.21 | 5.241 | 9′ 9″ | 558.51 | 74.66 | 23′ 9″ | 3314. | 443.01 |
| 2′ 8″ | 41.78 | 5.585 | 10′ | 587.52 | 78.54 | 24′ | 3384.10 | 452.39 |
| 2′ 9″ | 44.43 | 5.940 | 10′ 3″ | 617.26 | 82.52 | 24′ 3″ | 3455. | 461.86 |
| 2′ 10″ | 47.16 | 6.305 | 10′ 6″ | 640.74 | 86.59 | 24′ 6″ | 3526.60 | 471.44 |
| 2′ 11″ | 49.98 | 6.681 | 10′ 9″ | 678.95 | 90.76 | 24′ 9″ | 3598.90 | 481.11 |
| 3′ | 52.88 | 7.069 | 11′ | 710.90 | 95.03 | 25′ | 3672. | 490.87 |
| 3′ 1″ | 55.86 | 7.467 | 11′ 3″ | 743.58 | 99.40 | 25′ 3″ | 3745.80 | 500.74 |
| 3′ 2″ | 58.92 | 7.876 | 11′ 6″ | 776.99 | 103.87 | 25′ 6″ | 3820.30 | 510.71 |
| 3′ 3″ | 62.06 | 8.296 | 11′ 9″ | 811.14 | 108.43 | 25′ 9″ | 3895.60 | 520.77 |
| 3′ 4″ | 65.28 | 8.727 | 12′ | 846.03 | 113.10 | 26′ | 3971.60 | 530.93 |
| 3′ 5″ | 68.58 | 9.168 | 12′ 3″ | 881.65 | 117.86 | 26′ 3″ | 4048.40 | 541.19 |
| 3′ 6″ | 71.97 | 9.621 | 12′ 6″ | 918. | 122.72 | 26′ 6″ | 4125.90 | 551.55 |
| 3′ 7″ | 75.44 | 10.085 | 12′ 9″ | 955.09 | 127.68 | 26′ 9″ | 4204.10 | 562. |
| 3′ 8″ | 78.99 | 10.559 | 13′ | 992.91 | 132.73 | 27′ | 4283. | 572.66 |
| 3′ 9″ | 82.62 | 11.045 | 13′ 3″ | 1031.50 | 137.89 | 27′ 3″ | 4362.70 | 583.21 |
| 3′ 10″ | 86.33 | 11.541 | 13′ 6″ | 1070.80 | 143.14 | 27′ 6″ | 4443.10 | 593.96 |
| 3′ 11″ | 90.13 | 12.048 | 13′ 9″ | 1110.80 | 148.49 | 27′ 9″ | 4524.30 | 604.81 |
| 4′ | 94. | 12.566 | 14′ | 1151.50 | 153.94 | 28′ | 4606.20 | 615.75 |
| 4′ 1″ | 97.96 | 13.095 | 14′ 3″ | 1193. | 159.48 | 28′ 3″ | 4688.80 | 626.80 |
| 4′ 2″ | 102. | 13.635 | 14′ 6″ | 1235.30 | 165.13 | 28′ 6″ | 4772.10 | 637.94 |
| 4′ 3″ | 106.12 | 14.186 | 14′ 9″ | 1278.20 | 170.87 | 28′ 9″ | 4856.20 | 649.18 |
| 4′ 4″ | 110.32 | 14.748 | 15′ | 1321.90 | 176.71 | 29′ | 4941. | 660.52 |
| 4′ 5″ | 114.61 | 15.321 | 15′ 3″ | 1366.40 | 182.65 | 29′ 3″ | 5026.60 | 671.96 |
| 4′ 6″ | 118.97 | 15.90 | 15′ 6″ | 1411.50 | 188.69 | 29′ 6″ | 5112.90 | 683.49 |
| 4′ 7″ | 123.42 | 16.50 | 15′ 9″ | 1457.40 | 194.83 | 29′ 9″ | 5199.90 | 695.13 |
| 4′ 8″ | 127.95 | 17.10 | 16′ | 1504.10 | 201.06 | 30′ | 5287.70 | 706.86 |
| 4′ 9″ | 132.56 | 17.72 | 16′ 3″ | 1551.40 | 207.39 | 30′ 3″ | 5376.20 | 718.69 |
| 4′ 10″ | 137.25 | 18.35 | 16′ 6″ | 1599.50 | 213.82 | 30′ 6″ | 5465.40 | 730.62 |
| 4′ 11″ | 142.02 | 18.99 | 16′ 9″ | 1648.40 | 220.35 | 30′ 9″ | 5555.40 | 742.64 |
| 5′ | 146.88 | 19.63 | 17′ | 1697.90 | 226.98 | 31′ | 5646.10 | 754.77 |
| 5′ 1″ | 151.82 | 20.29 | 17′ 3″ | 1748.20 | 233.71 | 31′ 3″ | 5737.50 | 766.99 |
| 5′ 2″ | 156.83 | 20.97 | 17′ 6″ | 1799.30 | 240.53 | 31′ 6″ | 5829.70 | 779.31 |
| 5′ 3″ | 161.93 | 21.65 | 17′ 9″ | 1851.10 | 247.45 | 31′ 9″ | 5922.60 | 791.73 |
| 5′ 4″ | 167.12 | 22.34 | 18′ | 1903.60 | 254.47 | 32′ | 6016.20 | 804.25 |
| 5′ 5″ | 172.38 | 23.04 | 18′ 3″ | 1956.80 | 261.59 | 32′ 3″ | 6110.60 | 816.86 |
| 5′ 6″ | 177.72 | 23.76 | 18′ 6″ | 2010.80 | 268.80 | 32′ 6″ | 6205.70 | 829.58 |
| 5′ 7″ | 183.15 | 24.48 | 18′ 9″ | 2065.50 | 276.12 | 32′ 9″ | 6301.50 | 842.39 |

31½ Gall to 1 Bbl

**To find the capacity of tanks greater than the largest given in the table, look in the table for a tank of one-half of the given size and mult its capacity by 4, or one of one-third its size and mult its capacity by 9, etc.**

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## Capacity in Gals per Lin Ft of Cylinders

| Diam. | Capacity | Diam. | Capacity | Diam. | Capacity | Diam. | Capacity |
|---|---|---|---|---|---|---|---|
| 33 | 6398 | 50 | 14688 | 67 | 26374 | 84 | 41455 |
| 34 | 6792 | 51 | 15281 | 68 | 27167 | 85 | 42488 |
| 35 | 7197 | 52 | 15887 | 69 | 27972 | 86 | 43453 |
| 36 | 7614 | 53 | 16503 | 70 | 28788 | 87 | 44469 |
| 37 | 8043 | 54 | 17132 | 71 | 29617 | 88 | 45498 |
| 38 | 8484 | 55 | 17772 | 72 | 30457 | 89 | 46537 |
| 39 | 8936 | 56 | 18425 | 73 | 31309 | 90 | 47589 |
| 40 | 9400 | 57 | 19089 | 74 | 32173 | 91 | 48653 |
| 41 | 9876 | 58 | 19764 | 75 | 33048 | 92 | 49727 |
| 42 | 10364 | 59 | 20452 | 76 | 33935 | 93 | 50815 |
| 43 | 10863 | 60 | 21151 | 77 | 34834 | 94 | 51913 |
| 44 | 11374 | 61 | 21862 | 78 | 35745 | 95 | 53024 |
| 45 | 11897 | 62 | 22584 | 79 | 36667 | 96 | 54146 |
| 46 | 12432 | 63 | 23319 | 80 | 37601 | 97 | 55280 |
| 47 | 12978 | 64 | 24065 | 81 | 38547 | 98 | 56425 |
| 48 | 13536 | 65 | 24823 | 82 | 39505 | 99 | 57583 |
| 49 | 14106 | 66 | 25592 | 83 | 40474 | 100 | 58752 |

## Capacity in Gals of Tank Bottoms

| Diam. Feet | Hemispherical Bottom | Elliptical Bottom | Diam. Feet | Hemispherical Bottom | Elliptical Bottom |
|---|---|---|---|---|---|
| 13 | 4303 | 2151 | 32 | 64170 | 32085 |
| 14 | 5376 | 2688 | 33 | 70378 | 35189 |
| 15 | 6610 | 3305 | 34 | 76976 | 38488 |
| 16 | 8021 | 4011 | 35 | 83965 | 41983 |
| 17 | 9622 | 4811 | 36 | 91368 | 45684 |
| 18 | 11424 | 5712 | 37 | 99197 | 49599 |
| 19 | 13433 | 6717 | 38 | 107464 | 53732 |
| 20 | 15666 | 7833 | 39 | 116168 | 58084 |
| 21 | 18137 | 9069 | 40 | 125333 | 62667 |
| 22 | 20856 | 10428 | 41 | 134972 | 67486 |
| 23 | 23828 | 11914 | 42 | 145096 | 72548 |
| 24 | 27072 | 13536 | 43 | 155703 | 77851 |
| 25 | 30600 | 15300 | 44 | 166819 | 83410 |
| 26 | 34424 | 17212 | 45 | 178455 | 89228 |
| 27 | 38547 | 19274 | 46 | 190624 | 95312 |
| 28 | 42989 | 21495 | 47 | 203322 | 101661 |
| 29 | 47763 | 23881 | 48 | 216576 | 108288 |
| 30 | 52880 | 26440 | 49 | 230398 | 115199 |
| 31 | 58342 | 29171 | 50 | 244800 | 122400 |

The capacities for elliptical bottoms hold good only when the depth is one quarter the diameter.

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## PROPERTIES OF THE CIRCLE

Diam $\times$ 3.14159 = circumference.
Diam $\times$ .8862 = side of an equal sq.
Diam $\times$ .7071 = side of an inscribed sq.
Diam$^2$ $\times$ .7854 = area of a circle.
Radius $\times$ 6.28318 = circumference.
Circumference $\div$ 3.14159 = diam.

1st. The circle contains a greater area than any plane figure, bounded by an equal perimeter or outline.

2d. The areas of circles are to each other as the sq of their diam.

3d. Any circle whose diam is double that of another contains four times the area of the other.

4th. Area of a circle is equal to the area of a triangle whose base equals the circumference, and perpendicular equals the radius.

## USEFUL MEMORANDA AND TABLES

| | | |
|---|---|---|
| 1 ci of Cast Iron weighs | 0.26 | lbs |
| 1 ci of Wrought Iron weighs | 0.28 | lbs |
| 1 ci of Water weighs | .036 | lbs |
| 1 cf of Water weighs | 62.321 | lbs |
| 1 United States gall weighs | 8.33 | lbs |
| 1 Imperial gall weighs | 10. | lbs |
| 1 United States gall equals | 231. | ci |
| 1 Imperial gall equals | 277.274 | ci |
| 1 cf of Water equals | 7.48 | U. S. gall |

## CONVENIENT MULTIPLES

For the side of an equal sq of a circle, mult diam by .8862. For the surf of a sphere, mult sq of diam by 3.1446. For the Solidity of a sphere, mult cube of diam by .5236. For the side of an inscribed cube, mult the radius of a sphere by 1.1547. The area of the base of a pyramid, or cone, whether round, sq or triangular, mult by one-third of its height, equals the solidity. The base of a triangle mult by half the height equals the area.

## RULE

For finding the weight of castings or forgings by the weight of their patterns.

Mult the weight of the wp pattern by

| | |
|---|---|
| 16 for cast iron, | 25 for lead, |
| 17.1 for wrt iron, | 12.2 for tin, |
| 17.3 for steel, | 13 for brass, |
| 18 for copper, | 11.4 for zinc. |

and the product is the weight of the casting.

Material on this and following two pages reprinted from Arthur's New Building Estimators' Handbook.

## ROUND COPPER RODS

### Weight per Ft

| Diameter | Wgt per ft in length | Diameter | Wgt per ft in lengths |
|---|---|---|---|
| 3/8" | .424 lbs. | 1 1/4" | 4.71 lbs. |
| 1/2" | .755 lbs. | 1 3/8" | 5.71 lbs. |
| 5/8" | 1.19 lbs. | 1 1/2" | 6.79 lbs. |
| 3/4" | 1.69 lbs. | 1 5/8" | 7.94 lbs. |
| 7/8" | 2.31 lbs. | 1 3/4" | 9.21 lbs. |
| 1" | 3.02 lbs. | 1 7/8" | 10.61 lbs. |
| 1 1/8" | 3.82 lbs. | 2" | 12.08 lbs. |

## METALS

### Weight per Sq Ft

| Thickness | Wro't Iron | Cast Iron | Steel | Copper | Brass | Lead | Zinc |
|---|---|---|---|---|---|---|---|
| | lbs | lbs | lbs | lbs | lbs | lbs | lbs |
| 1/16" | 2.51 | 2.34 | 2.55 | 2.89 | 2.67 | 3.69 | 2.34 |
| 1/8" | 5.03 | 4.69 | 5.10 | 5.78 | 5.35 | 7.38 | 4.68 |
| 3/16" | 7.58 | 7.03 | 7.66 | 8.67 | 8.02 | 11.07 | 7.02 |
| 1/4" | 10.07 | 9.38 | 10.21 | 11.56 | 10.7 | 14.76 | 9.36 |
| 5/16" | 12.58 | 11.73 | 12.71 | 14.45 | 13.37 | 18.45 | 11.7 |
| 3/8" | 15.10 | 14.07 | 15.31 | 17.34 | 16.05 | 22.14 | 14.04 |
| 7/16" | 17.62 | 16.42 | 17.87 | 20.23 | 18.72 | 25.83 | 16.34 |
| 1/2" | 20.14 | 18.77 | 20.42 | 23.12 | 21.4 | 29.53 | 18.72 |
| 9/16" | 22.65 | 21.11 | 22.97 | 26.01 | 24.07 | 33.22 | 21.08 |
| 5/8" | 25.17 | 23.46 | 25.52 | 28.90 | 26.75 | 36.91 | 23.44 |
| 11/16" | 27.69 | 25.81 | 28.08 | 31.97 | 29.42 | 40.60 | 25.80 |
| 3/4" | 30.21 | 28.15 | 30.63 | 34.68 | 32.1 | 44.29 | 28.13 |
| 13/16" | 32.72 | 30.50 | 33.18 | 37.57 | 35.19 | 47.98 | 30.49 |
| 7/8" | 35.24 | 32.85 | 35.73 | 40.69 | 38.28 | 51.67 | 32.81 |
| 15/16" | 37.76 | 35.19 | 28.28 | 43.35 | 41.37 | 55.37 | 35.17 |
| 1" | 40.28 | 37.54 | 40.83 | 46.25 | 43.75 | 59.06 | 37.50 |

BRICK:—Common brick of the national size weigh from 4½ to 5 lbs; pressed and paving, from 6 to 7, depending upon clay, burning and size.

LIME:—On the basis of 53 lbs to the cf lime weighs about 66 lbs to the bushel, but in bulk it is often sold on the basis of 80 lbs or 200 lbs to the bbl of 2½ bushels.

## WEIGHTS OF VARIOUS SUBSTANCES PER CO FT

| Names of Substances | Average Wgt, Lbs |
|---|---|
| Ash, American White, Dry | 38 |
| Asphaltum | 87 |
| Brass (Copper and Zinc) Cast | 504 |
| Brass Rolled | 524 |
| Brick, Best Pressed | 150 |
| Brick, Common Hard | 125 |
| Brick, Soft, Inferior | 100 |
| Brick, Fire | 137 |
| Brickwork, Pressed Brick | 140 |
| Brickwork, Ordinary | 112 |

| Names of Substances | Average Wgt, Lbs |
|---|---|
| Cement, Hydraulic, Ground, Loose, American, Rosendale | 56 |
| Cement, Hydraulic, Ground, Loose, American, Louisville | 50 |
| Cement, Hydraulic, Ground, Loose, English, Portland | 90 |
| Cherry, Dry | 42 |
| Chestnut, Dry | 41 |
| Concrete | 140 |
| Copper, Cast | 543 |
| Copper, Rolled | 548 |
| Ebony, Dry | 76 |
| Elm, Dry | 35 |
| Flint | 162 |
| Glass, Common Window | 157 |
| Gneiss, Common | 168 |
| Granite | 170 |
| Gravel, about the same as Sand, which see | |
| Hemlock, Dry | 25 |
| Hickory, Dry | 53 |
| Ice | 50 to 58 |
| Iron, Cast | 450 |
| Iron, Wrt, Purest | 485 |
| Iron, Wrt, Average | 480 |
| Lead | 711 |
| Lime, Quick, Ground, Loose, or in Small Lumps | 53 |
| Lime, Quick, Ground, Loose, Thoroughly Shaken | 75 |
| Lime, Quick, Ground, Loose, Per Struck Bushel | 66 |
| Limestones and Marbles | 168 |
| Limestones and Marbles, Loose, in Irregular Fragments | 96 |
| Mahogany, Spanish, Dry | 53 |
| Mahogany, Honduras, Dry | 35 |
| Maple, Dry | 49 |
| Marbles, see Limestones. | |
| Masonry, of Granite or Limestone, well dressed | 165 |
| Masonry, of Mortar Rubble | 154 |
| Masonry, of Dry Rubble (well Scabbled) | 138 |
| Masonry, of Sandstone, well dressed | 144 |
| Mortar, Hardened | 103 |
| Oak, Live, Dry | 59 |
| Oak, White, Dry | 52 |
| Oak, Other Kinds | 32 to 45 |
| Pine, White, Dry | 25 |
| Pine, Yellow, Northern | 34 |
| Pine, Yellow, Southern | 45 |
| Plaster of Paris | 74 |
| Quartz, Common, Pure | 165 |
| Sand, of Pure Quartz, Dry, Loose | 90 to 106 |
| Sand, Well Shaken | 99 to 117 |
| Sand, Perfectly Wet | 120 to 140 |
| Sandstones, Fit for Building | 151 |
| Shales, Red or Black | 162 |
| Slate | 175 |
| Snow, freshly fallen | 5 to 12 |
| Snow, Moistened and Compacted by Rain | 15 to 50 |
| Spruce, Dry | 25 |
| Steel | 490 |
| Sycamore, Dry | 37 |
| Tar | 62 |
| Tin, Cast | 459 |
| Walnut, Black, Dry | 38 |
| Water, Pure Rain or Distilled, at 60° Fahrenheit | 62½ |
| Water, Sea | 64 |
| Zinc or Spelter | 437 |

Green Timbers usually weigh from one-fifth to one-half more than dry.

## Weights and Measures

### Decimal Equivalents for Fractions of an Inch

| 1/32 | 1/64 | Decimals | Fractions | 1/32 | 1/64 | Decimals | Fractions |
|---|---|---|---|---|---|---|---|
| ..... | 1 | 0.015625 | ..... | ..... | 33 | 0.515625 | ..... |
| 1 | 2 | 0.03125 | ..... | 17 | 34 | 0.53125 | ..... |
| ..... | 3 | 0.046875 | ..... | ..... | 35 | 0.546875 | ..... |
| 2 | 4 | 0.0625 | 1/16 | 18 | 36 | 0.5625 | 9/16 |
| ..... | 5 | 0.078125 | ..... | ..... | 37 | 0.578125 | ..... |
| 3 | 6 | 0.09375 | ..... | 19 | 38 | 0.59375 | ..... |
| ..... | 7 | 0.109375 | ..... | ..... | 39 | 0.609375 | ..... |
| 4 | 8 | 0.125 | 1/8 | 20 | 40 | 0.625 | 5/8 |
| ..... | 9 | 0.140625 | ..... | ..... | 41 | 0.640625 | ..... |
| 5 | 10 | 0.15625 | ..... | 21 | 42 | 0.65625 | ..... |
| ..... | 11 | 0.171875 | ..... | ..... | 43 | 0.671875 | ..... |
| 6 | 12 | 0.1875 | 3/16 | 22 | 44 | 0.6875 | 11/16 |
| ..... | 13 | 0.203125 | ..... | ..... | 45 | 0.703125 | ..... |
| 7 | 14 | 0.21875 | ..... | 23 | 46 | 0.71875 | ..... |
| ..... | 15 | 0.234375 | ..... | ..... | 47 | 0.734375 | ..... |
| 8 | 16 | 0.25 | 1/4 | 24 | 48 | 0.75 | 3/4 |
| ..... | 17 | 0.265625 | ..... | ..... | 49 | 0.765625 | ..... |
| 9 | 18 | 0.28125 | ..... | 25 | 50 | 0.78125 | ..... |
| ..... | 19 | 0.296875 | ..... | ..... | 51 | 0.796875 | ..... |
| 10 | 20 | 0.3125 | 5/16 | 26 | 52 | 0.8125 | 13/16 |
| ..... | 21 | 0.328125 | ..... | ..... | 53 | 0.828125 | ..... |
| 11 | 22 | 0.34375 | ..... | 27 | 54 | 0.84375 | ..... |
| ..... | 23 | 0.359375 | ..... | ..... | 55 | 0.859375 | ..... |
| 12 | 24 | 0.375 | 3/8 | 28 | 56 | 0.875 | 7/8 |
| ..... | 25 | 0.390625 | ..... | ..... | 57 | 0.890625 | ..... |
| 13 | 26 | 0.40625 | ..... | 29 | 58 | 0.90625 | ..... |
| ..... | 27 | 0.421875 | ..... | ..... | 59 | 0.921875 | ..... |
| 14 | 28 | 0.4375 | 7/16 | 30 | 60 | 0.9375 | 15/16 |
| ..... | 29 | 0.453125 | ..... | ..... | 61 | 0.953125 | ..... |
| 15 | 30 | 0.46875 | ..... | 31 | 62 | 0.96875 | ..... |
| ..... | 31 | 0.484375 | ..... | ..... | 63 | 0.984375 | ..... |
| 16 | 32 | 0.5 | 1/2 | 32 | 64 | 1. | 1 |

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## Measures of Length

12 inches = 1 foot
3 feet = 1 yard = 36 inches
5½ yards = 1 rod = 198 inches = 16½ feet
40 rods = 1 furlong = 7 920 inches = 660 feet = 220 yards
8 furlongs = 1 mile = 63 360 inches = 5 280 feet = 1 760 yards = 320 rods
1 yard = 0.0005682 of a mile

### Gunter's Chain

7.92 inches = 1 link
100 links = 1 chain = 4 rods = 66 feet
80 chains = 1 mile

### Ropes and Cables

6 feet = 1 fathom 120 fathoms = 1 cable's length

### Table Showing Inches Expressed in Decimals of a Foot

| In | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Foot | .0833 | .1667 | .2500 | .3333 | .4167 | .5000 | .5833 | .6667 | .7500 | .8333 | .9167 |
| 1–32 | .0026 | .0859 | .1693 | .2526 | .3359 | .4193 | .5026 | .5859 | .6693 | .7526 | .8359 | .9193 |
| 1–16 | .0052 | .0885 | .1719 | .2552 | .3385 | .4219 | .5052 | .5885 | .6719 | .7552 | .8385 | .9219 |
| 3–32 | .0078 | .0911 | .1745 | .2578 | .3411 | .4245 | .5078 | .5911 | .6745 | .7578 | .8411 | .9245 |
| 1–8 | .0104 | .0938 | .1771 | .2604 | .3438 | .4271 | .5104 | .5938 | .6771 | .7604 | .8438 | .9271 |
| 5–32 | .0130 | .0964 | .1797 | .2630 | .3464 | .4297 | .5130 | .5964 | .6797 | .7630 | .8464 | .9297 |
| 3–16 | .0156 | .0990 | .1823 | .2656 | .3490 | .4323 | .5156 | .5990 | .6823 | .7656 | .8490 | .9323 |
| 7–32 | .0182 | .1016 | .1849 | .2682 | .3516 | .4349 | .5182 | .6016 | .6849 | .7682 | .8516 | .9349 |
| 1–4 | .0208 | .1042 | .1875 | .2708 | .3542 | .4375 | .5208 | .6042 | .6875 | .7708 | .8542 | .9375 |
| 9–32 | .0234 | .1068 | .1901 | .2734 | .3568 | .4401 | .5234 | .6068 | .6901 | .7734 | .8568 | .9401 |
| 5–16 | .0260 | .1094 | .1927 | .2760 | .3594 | .4427 | .5260 | .6094 | .6927 | .7760 | .8594 | .9427 |
| 11–32 | .0286 | .1120 | .1953 | .2786 | .3620 | .4453 | .5286 | .6120 | .6953 | .7786 | .8620 | .9453 |
| 3–8 | .0313 | .1146 | .1979 | .2813 | .3646 | .4479 | .5313 | .6146 | .6979 | .7813 | .8646 | .9479 |
| 13–32 | .0339 | .1172 | .2005 | .2839 | .3672 | .4505 | .5339 | .6172 | .7005 | .7839 | .8672 | .9505 |
| 7–16 | .0365 | .1198 | .2031 | .2865 | .3698 | .4531 | .5365 | .6198 | .7031 | .7865 | .8698 | .9531 |
| 15–32 | .0391 | .1224 | .2057 | .2891 | .3724 | .4557 | .5391 | .6224 | .7057 | .7891 | .8724 | .9557 |
| 1–2 | .0417 | .1250 | .2083 | .2917 | .3750 | .4583 | .5417 | .6250 | .7083 | .7917 | .8750 | .9583 |
| 17–32 | .0443 | .1276 | .2109 | .2943 | .3776 | .4609 | .5443 | .6276 | .7109 | .7943 | .8776 | .9609 |
| 9–16 | .0469 | .1302 | .2135 | .2969 | .3802 | .4635 | .5469 | .6302 | .7135 | .7969 | .8802 | .9635 |
| 19–32 | .0495 | .1328 | .2161 | .2995 | .3828 | .4661 | .5495 | .6328 | .7161 | .7995 | .8828 | .9661 |
| 5–8 | .0521 | .1354 | .2188 | .3021 | .3854 | .4688 | .5521 | .6354 | .7188 | .8021 | .8854 | .9688 |
| 21–32 | .0547 | .1380 | .2214 | .3047 | .3880 | .4714 | .5547 | .6380 | .7214 | .8047 | .8880 | .9714 |
| 11–16 | .0573 | .1406 | .2240 | .3073 | .3906 | .4740 | .5573 | .6406 | .7240 | .8073 | .8906 | .9740 |
| 23–32 | .0599 | .1432 | .2266 | .3099 | .3932 | .4766 | .5599 | .6432 | .7266 | .8099 | .8932 | .9766 |
| 3–4 | .0625 | .1458 | .2292 | .3125 | .3958 | .4792 | .5625 | .6458 | .7292 | .8125 | .8958 | .9792 |
| 25–32 | .0651 | .1484 | .2318 | .3151 | .3984 | .4818 | .5651 | .6484 | .7318 | .8151 | .8984 | .9818 |
| 13–16 | .0677 | .1510 | .2344 | .3177 | .4010 | .4844 | .5677 | .6510 | .7344 | .8177 | .9010 | .9844 |
| 27–32 | .0703 | .1536 | .2370 | .3203 | .4036 | .4870 | .5703 | .6536 | .7370 | .8203 | .9036 | .9870 |
| 7–8 | .0729 | .1563 | .2396 | .3229 | .4063 | .4896 | .5729 | .6563 | .7396 | .8229 | .9063 | .9896 |
| 29–32 | .0755 | .1589 | .2422 | .3255 | .4089 | .4922 | .5755 | .6589 | .7422 | .8255 | .9089 | .9922 |
| 15–16 | .0781 | .1615 | .2448 | .3281 | .4115 | .4948 | .5781 | .6615 | .7448 | .8281 | .9115 | .9948 |
| 31–32 | .0807 | .1641 | .2474 | .3307 | .4141 | .4974 | .5807 | .6641 | .7474 | .8307 | .9141 | .9974 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

## Metric Conversion Table

| | |
|---|---|
| Millimeters × 0.03937 | = inches |
| Millimeters ÷ 25.4 | = inches |
| Centimeters × 0.3937 | = inches |
| Centimeters ÷ 2.54 | = inches |
| Meters × 39.37 | = inches (Act of Congress) |
| Meters × 3.281 | = feet |
| Meters × 1.094 | = yards |
| Kilometers × 0.621 | = miles |
| Kilometers ÷ 1.6093 | = miles |
| Kilometers × 3280.7 | = feet |
| Square millimeters × 0.0155 | = square inches |
| Square millimeters ÷ 645.1 | = square inches |
| Square centimeters × 0.155 | = square inches |
| Square centimeters ÷ 6.451 | = square inches |
| Square meters × 10.764 | = square feet |
| Square kilometers × 247.1 | = acres |
| Hectares × 2.471 | = acres |
| Cubic centimeters ÷ 16.383 | = cubic inches |
| Cubic centimeters ÷ 3.69 | = fluid drachms (U.S. Pharmacopœia) |
| Cubic centimeters ÷ 29.57 | = fluid ounce. (U.S. Pharmacopœia) |
| Cubic meters × 35.315 | = cubic feet |
| Cubic meters × 1.308 | = cubic yards |
| Cubic meters × 264.2 | = gallons (231 cubic inches) |
| Liters × 61.022 | = cubic inches. (Act of Congress) |
| Liters × 33.84 | = fluid ounces. (U.S. Pharmacopœia) |
| Liters × 0.2642 | = gallons (231 cubic inches) |
| Liters ÷ 3.78 | = gallons (231 cubic inches) |
| Liters ÷ 28.316 | = cubic feet |
| Hectoliters × 3.531 | = cubic feet |
| Hectoliters × 2.84 | = bushels (2 150.42 cubic inches) |
| Hectoliters × 0.131 | = cubic yards |
| Hectoliters × 26.42 | = gallons (231 cubic inches) |
| Grams × 15.432 | = grains. (Act of Congress) |
| Grams × 981 | = dynes |
| Grams (water) ÷ 29.57 | = fluid ounces |
| Grams ÷ 28.35 | = ounces avoirdupois |
| Grams per cubic centimeter ÷ 27.7 | = pounds per cubic inch |
| Joule × 0.7373 | = foot-pounds |
| Kilograms × 2.2046 | = pounds |
| Kilograms × 35.3 | = ounces avoirdupois |
| Kilograms ÷ 1102.3 | = tons (2 000 pounds) |
| Kilograms per sq cm × 14.223 | = pounds per square inch |
| Kilogrammeters × 7.233 | = foot-pounds |
| Kilograms per meter × 0.672 | = pounds per square foot |
| Kilograms per cubic meter × 0.062 | = pounds per cubic foot |
| Kilograms per cheval-vapeur × 2.235 | = pounds per horse-power |
| Kilowatts × 1.34 | = horse-power |
| Watts ÷ 746 | = horse-power |
| Watts × 0.7373 | = foot-pounds per second |
| Calorie × 3.968 | = British thermal units (B.T.U.) |

## Areas and Circumferences of Circles

For diameters from 1/10 to 100, advancing by tenths

| Dia. | Area | Circum. | Dia. | Area | Circum. | Dia. | Area | Circum. |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | 5.0 | 19.6350 | 15.7080 | 10.0 | 78.5398 | 31.4159 |
| .1 | 0.007854 | 0.31416 | .1 | 20.4282 | 16.0221 | .1 | 80.1185 | 31.7301 |
| .2 | 0.031416 | 0.62832 | .2 | 21.2372 | 16.3363 | .2 | 81.7128 | 32.0442 |
| .3 | 0.070686 | 0.94248 | .3 | 22.0618 | 16.6504 | .3 | 83.3229 | 32.3584 |
| .4 | 0.12566 | 1.2566 | .4 | 22.9022 | 16.9646 | .4 | 84.9487 | 32.6726 |
| .5 | 0.19635 | 1.5708 | .5 | 23.7583 | 17.2788 | .5 | 86.5901 | 32.9867 |
| .6 | 0.28274 | 1.8850 | .6 | 24.6301 | 17.5929 | .6 | 88.2473 | 33.3009 |
| .7 | 0.38485 | 2.1991 | .7 | 25.5176 | 17.9071 | .7 | 89.9202 | 33.6150 |
| .8 | 0.50266 | 2.5133 | .8 | 26.4208 | 18.2212 | .8 | 91.6088 | 33.9292 |
| .9 | 0.63617 | 2.8274 | .9 | 27.3397 | 18.5354 | .9 | 93.3132 | 34.2434 |
| 1.0 | 0.7854 | 3.1416 | 6.0 | 28.2743 | 18.8496 | 11.0 | 95.0332 | 34.5575 |
| .1 | 0.9503 | 3.4558 | .1 | 29.2247 | 19.1637 | .1 | 96.7689 | 34.8717 |
| .2 | 1.1310 | 3.7699 | .2 | 30.1907 | 19.4779 | .2 | 98.5203 | 35.1858 |
| .3 | 1.3273 | 4.0841 | .3 | 31.1725 | 19.7920 | .3 | 100.2875 | 35.5000 |
| .4 | 1.5394 | 4.3982 | .4 | 32.1699 | 20.1062 | .4 | 102.0703 | 35.8142 |
| .5 | 1.7671 | 4.7124 | .5 | 33.1831 | 20.4201 | .5 | 103.8689 | 36.1283 |
| .6 | 2.0106 | 5.0265 | .6 | 34.2119 | 20.7345 | .6 | 105.6832 | 36.4425 |
| .7 | 2.2698 | 5.3407 | .7 | 35.2565 | 21.0487 | .7 | 107.5132 | 36.7566 |
| .8 | 2.5447 | 5.6549 | .8 | 36.3168 | 21.3628 | .8 | 109.3588 | 37.0708 |
| .9 | 2.8353 | 5.9690 | .9 | 37.3928 | 21.6770 | .9 | 111.2202 | 37.3850 |
| 2.0 | 3.1416 | 6.2832 | 7.0 | 38.4845 | 21.9911 | 12.0 | 113.0973 | 37.6991 |
| .1 | 3.4636 | 6.5973 | .1 | 39.5919 | 22.3053 | .1 | 114.9901 | 38.0133 |
| .2 | 3.8013 | 6.9115 | .2 | 40.7150 | 22.6195 | .2 | 116.8987 | 38.3274 |
| .3 | 4.1548 | 7.2257 | .3 | 41.8539 | 22.9336 | .3 | 118.8229 | 38.6416 |
| .4 | 4.5239 | 7.5398 | .4 | 43.0084 | 23.2478 | .4 | 120.7628 | 38.9557 |
| .5 | 4.9087 | 7.8540 | .5 | 44.1786 | 23.5619 | .5 | 122.7185 | 39.2699 |
| .6 | 5.3093 | 8.1681 | .6 | 45.3646 | 23.8761 | .6 | 124.6898 | 39.5841 |
| .7 | 5.7256 | 8.4823 | .7 | 46.5663 | 24.1903 | .7 | 126.6769 | 39.8982 |
| .8 | 6.1575 | 8.7965 | .8 | 47.7836 | 24.5044 | .8 | 128.6796 | 40.2124 |
| .9 | 6.6052 | 9.1106 | .9 | 49.0167 | 24.8186 | .9 | 130.6981 | 40.5265 |
| 3.0 | 7.0686 | 9.4248 | 8.0 | 50.2655 | 25.1327 | 13.0 | 132.7323 | 40.8407 |
| .1 | 7.5477 | 9.7389 | .1 | 51.5300 | 25.4469 | .1 | 134.7822 | 41.1549 |
| .2 | 8.0425 | 10.0531 | .2 | 52.8102 | 25.7611 | .2 | 136.8478 | 41.4690 |
| .3 | 8.5530 | 10.3673 | .3 | 54.1061 | 26.0752 | .3 | 138.9291 | 41.7832 |
| .4 | 9.0792 | 10.6814 | .4 | 55.4177 | 26.3894 | .4 | 141.0261 | 42.0973 |
| .5 | 9.6211 | 10.9956 | .5 | 56.7450 | 26.7035 | .5 | 143.1388 | 42.4115 |
| .6 | 10.1788 | 11.3097 | .6 | 58.0880 | 27.0177 | .6 | 145.2672 | 42.7257 |
| .7 | 10.7521 | 11.6239 | .7 | 59.4468 | 27.3319 | .7 | 147.4114 | 43.0398 |
| .8 | 11.3411 | 11.9381 | .8 | 60.8212 | 27.6460 | .8 | 149.5712 | 43.3540 |
| .9 | 11.9459 | 12.2522 | .9 | 62.2114 | 27.9602 | .9 | 151.7468 | 43.6681 |
| 4.0 | 12.5664 | 12.5664 | 9.0 | 63.6173 | 28.2743 | 14.0 | 153.9380 | 43.9823 |
| .1 | 13.2025 | 12.8805 | .1 | 65.0388 | 28.5885 | .1 | 156.1450 | 44.2965 |
| .2 | 13.8544 | 13.1947 | .2 | 66.4761 | 28.9027 | .2 | 158.3677 | 44.6106 |
| .3 | 14.5220 | 13.5088 | .3 | 67.9291 | 29.2168 | .3 | 160.6061 | 44.9248 |
| .4 | 15.2053 | 13.8230 | .4 | 69.3978 | 29.5310 | .4 | 162.8602 | 45.2389 |
| .5 | 15.9043 | 14.1372 | .5 | 70.8822 | 29.8451 | .5 | 165.1300 | 45.5531 |
| .6 | 16.6190 | 14.4513 | .6 | 72.3823 | 30.1593 | .6 | 167.4155 | 45.8673 |
| .7 | 17.3494 | 14.7655 | .7 | 73.8981 | 30.4734 | .7 | 169.7167 | 46.1814 |
| .8 | 18.0956 | 15.0796 | .8 | 75.4296 | 30.7876 | .8 | 172.0336 | 46.4956 |
| .9 | 18.8574 | 15.3938 | .9 | 76.9769 | 31.1018 | .9 | 174.3662 | 46.8097 |

## Table of Areas and Circumferences of Circles

### Areas and Circumferences of Circles (Continued)

Advancing by tenths

| Dia. | Area | Circum. | Dia. | Area | Circum. | Dia. | Area | Circum. |
|---|---|---|---|---|---|---|---|---|
| 15.0 | 176.7146 | 47.1239 | 20.0 | 314.1593 | 62.8319 | 25.0 | 490.8739 | 78.5398 |
| .1 | 179.0786 | 47.4380 | .1 | 317.3087 | 63.1460 | .1 | 494.8087 | 78.8540 |
| .2 | 181.4584 | 47.7522 | .2 | 320.4739 | 63.4602 | .2 | 498.7592 | 79.1681 |
| .3 | 183.8539 | 48.0664 | .3 | 323.6547 | 63.7743 | .3 | 502.7255 | 79.4823 |
| .4 | 186.2650 | 48.3805 | .4 | 326.8513 | 64.0885 | .4 | 506.7075 | 79.7965 |
| .5 | 188.6919 | 48.6947 | .5 | 330.0636 | 64.4026 | .5 | 510.7052 | 80.1106 |
| .6 | 191.1345 | 49.0088 | .6 | 333.2916 | 64.7168 | .6 | 514.7185 | 80.4248 |
| .7 | 193.5928 | 49.3230 | .7 | 336.5353 | 65.0310 | .7 | 518.7476 | 80.7389 |
| .8 | 196.0668 | 49.6372 | .8 | 339.7947 | 65.3451 | .8 | 522.7924 | 81.0531 |
| .9 | 198.5565 | 49.9513 | .9 | 343.0698 | 65.6593 | .9 | 526.8529 | 81.3672 |
| 16.0 | 201.0619 | 50.2655 | 21.0 | 346.3606 | 65.9734 | 26.0 | 530.9292 | 81.6814 |
| .1 | 203.5831 | 50.5796 | .1 | 349.6671 | 66.2876 | .1 | 535.0211 | 81.9956 |
| .2 | 206.1199 | 50.8938 | .2 | 352.9894 | 66.6018 | .2 | 539.1287 | 82.3097 |
| .3 | 208.6724 | 51.2080 | .3 | 356.3273 | 66.9159 | .3 | 543.2521 | 82.6239 |
| .4 | 211.2407 | 51.5221 | .4 | 359.6809 | 67.2301 | .4 | 547.3911 | 82.9380 |
| .5 | 213.8246 | 51.8363 | .5 | 363.0503 | 67.5442 | .5 | 551.5459 | 83.2522 |
| .6 | 216.4243 | 52.1504 | .6 | 366.4354 | 67.8584 | .6 | 555.7163 | 83.5664 |
| .7 | 219.0397 | 52.4646 | .7 | 369.8361 | 68.1726 | .7 | 559.9025 | 83.8805 |
| .8 | 221.6708 | 52.7788 | .8 | 373.2526 | 68.4867 | .8 | 564.1044 | 84.1947 |
| .9 | 224.3176 | 53.0929 | .9 | 376.6848 | 68.8009 | .9 | 568.3220 | 84.5088 |
| 17.0 | 226.9801 | 53.4071 | 22.0 | 380.1327 | 69.1150 | 27.0 | 572.5553 | 84.8230 |
| .1 | 229.6583 | 53.7212 | .1 | 383.5963 | 69.4292 | .1 | 576.8043 | 85.1372 |
| .2 | 232.3522 | 54.0354 | .2 | 387.0756 | 69.7434 | .2 | 581.0690 | 85.4513 |
| .3 | 235.0618 | 54.3496 | .3 | 390.5707 | 70.0575 | .3 | 585.3494 | 85.7655 |
| .4 | 237.7871 | 54.6637 | .4 | 394.0814 | 70.3717 | .4 | 589.6455 | 86.0796 |
| .5 | 240.5282 | 54.9779 | .5 | 397.6078 | 70.6858 | .5 | 593.9574 | 86.3938 |
| .6 | 243.2849 | 55.2920 | .6 | 401.1500 | 71.0000 | .6 | 598.2849 | 86.7080 |
| .7 | 246.0574 | 55.6062 | .7 | 404.7078 | 71.3142 | .7 | 602.6282 | 87.0221 |
| .8 | 248.8456 | 55.9203 | .8 | 408.2814 | 71.6283 | .8 | 606.9871 | 87.3363 |
| .9 | 251.6494 | 56.2345 | .9 | 411.8707 | 71.9425 | .9 | 611.3618 | 87.6504 |
| 18.0 | 254.4690 | 56.5486 | 23.0 | 415.4756 | 72.2566 | 28.0 | 615.7522 | 87.9646 |
| .1 | 257.3043 | 56.8628 | .1 | 419.0963 | 72.5708 | .1 | 620.1582 | 88.2788 |
| .2 | 260.1553 | 57.1770 | .2 | 422.7327 | 72.8849 | .2 | 624.5800 | 88.5929 |
| .3 | 263.0220 | 57.4911 | .3 | 426.3848 | 73.1991 | .3 | 629.0175 | 88.9071 |
| .4 | 265.9044 | 57.8053 | .4 | 430.0526 | 73.5133 | .4 | 633.4707 | 89.2212 |
| .5 | 268.8025 | 58.1195 | .5 | 433.7361 | 73.8274 | .5 | 637.9397 | 89.5354 |
| .6 | 271.7164 | 58.4336 | .6 | 437.4354 | 74.1416 | .6 | 642.4243 | 89.8495 |
| .7 | 274.6459 | 58.7478 | .7 | 441.1503 | 74.4557 | .7 | 646.9246 | 90.1637 |
| .8 | 277.5911 | 59.0619 | .8 | 444.8809 | 74.7699 | .8 | 651.4407 | 90.4779 |
| .9 | 280.5521 | 59.3761 | .9 | 448.6273 | 75.0841 | .9 | 655.9724 | 90.7920 |
| 19.0 | 283.5287 | 59.6903 | 24.0 | 452.3893 | 75.3982 | 29.0 | 660.5199 | 91.1062 |
| .1 | 286.5211 | 60.0044 | .1 | 456.1671 | 75.7124 | .1 | 665.0830 | 91.4203 |
| .2 | 289.5292 | 60.3186 | .2 | 459.9606 | 76.0265 | .2 | 669.6619 | 91.7345 |
| .3 | 292.5530 | 60.6327 | .3 | 463.7698 | 76.3407 | .3 | 674.2565 | 92.0487 |
| .4 | 295.5925 | 60.9469 | .4 | 467.5947 | 76.6549 | .4 | 678.8668 | 92.3628 |
| .5 | 298.6477 | 61.2611 | .5 | 471.4352 | 76.9690 | .5 | 683.4928 | 92.6770 |
| .6 | 301.7186 | 61.5752 | .6 | 475.2916 | 77.2832 | .6 | 688.1345 | 92.9911 |
| .7 | 304.8052 | 61.8894 | .7 | 479.1636 | 77.5973 | .7 | 692.7919 | 93.3053 |
| .8 | 307.9075 | 62.2035 | .8 | 483.0513 | 77.9115 | .8 | 697.4650 | 93.6195 |
| .9 | 311.0255 | 62.5177 | .9 | 486.9547 | 78.2257 | .9 | 702.1538 | 93.9336 |

## Geometry and Mensuration

### Areas and Circumferences of Circles (Continued)

Advancing by tenths

| Dia. | Area | Circum. | Dia. | Area | Circum. | Dia. | Area | Circum. |
|---|---|---|---|---|---|---|---|---|
| 30.0 | 706.8583 | 94.2478 | 35.0 | 962.1128 | 109.9557 | 40.0 | 1256.6371 | 125.6637 |
| .1 | 711.5786 | 94.5619 | .1 | 967.6184 | 110.2699 | .1 | 1262.9281 | 125.9779 |
| .2 | 716.3145 | 94.8761 | .2 | 973.1397 | 110.5841 | .2 | 1269.2348 | 126.2920 |
| .3 | 721.0662 | 95.1903 | .3 | 978.6768 | 110.8982 | .3 | 1275.5573 | 126.6062 |
| .4 | 725.8336 | 95.5044 | .4 | 984.2296 | 111.2124 | .4 | 1281.8955 | 126.9203 |
| .5 | 730.6167 | 95.8186 | .5 | 989.7980 | 111.5265 | .5 | 1288.2493 | 127.2345 |
| .6 | 735.4154 | 96.1327 | .6 | 995.3822 | 111.8407 | .6 | 1294.6189 | 127.5487 |
| .7 | 740.2299 | 96.4469 | .7 | 1000.9821 | 112.1549 | .7 | 1301.0042 | 127.8628 |
| .8 | 745.0601 | 96.7611 | .8 | 1006.5977 | 112.4690 | .8 | 1307.4052 | 128.1770 |
| .9 | 749.9060 | 97.0752 | .9 | 1012.2290 | 112.7832 | .9 | 1313.8219 | 128.4911 |
| 31.0 | 754.7676 | 97.3894 | 36.0 | 1017.8760 | 113.0973 | 41.0 | 1320.2543 | 128.8053 |
| .1 | 759.6450 | 97.7035 | .1 | 1023.5387 | 113.4115 | .1 | 1326.7024 | 129.1195 |
| .2 | 764.5380 | 98.0177 | .2 | 1029.2172 | 113.7257 | .2 | 1333.1663 | 129.4336 |
| .3 | 769.4467 | 98.3319 | .3 | 1034.9113 | 114.0398 | .3 | 1339.6458 | 129.7478 |
| .4 | 774.3712 | 98.6460 | .4 | 1040.6212 | 114.3540 | .4 | 1346.1410 | 130.0619 |
| .5 | 779.3113 | 98.9602 | .5 | 1046.3467 | 114.6681 | .5 | 1352.6520 | 130.3761 |
| .6 | 784.2672 | 99.2743 | .6 | 1052.0880 | 114.9823 | .6 | 1359.1786 | 130.6903 |
| .7 | 789.2388 | 99.5885 | .7 | 1057.8449 | 115.2965 | .7 | 1365.7210 | 131.0044 |
| .8 | 794.2260 | 99.9026 | .8 | 1063.6176 | 115.6106 | .8 | 1372.2791 | 131.3186 |
| .9 | 799.2290 | 100.2168 | .9 | 1069.4060 | 115.9248 | .9 | 1378.8529 | 131.6327 |
| 32.0 | 804.2477 | 100.5310 | 37.0 | 1075.2101 | 116.2389 | 42.0 | 1385.4424 | 131.9469 |
| .1 | 809.2821 | 100.8451 | .1 | 1031.0299 | 116.5531 | .1 | 1392.0476 | 132.2611 |
| .2 | 814.3322 | 101.1593 | .2 | 1036.8654 | 116.8672 | .2 | 1398.6685 | 132.5752 |
| .3 | 819.3980 | 101.4734 | .3 | 1092.7166 | 117.1814 | .3 | 1405.3051 | 132.8894 |
| .4 | 824.4796 | 101.7876 | .4 | 1098.5835 | 117.4956 | .4 | 1411.9574 | 133.2035 |
| .5 | 829.5768 | 102.1018 | .5 | 1104.4662 | 117.8097 | 5 | 1418.6254 | 133.5177 |
| .6 | 834.6898 | 102.4159 | .6 | 1110.3645 | 118.1239 | .6 | 1425.3092 | 133.8318 |
| .7 | 839.8185 | 102.7301 | .7 | 1116.2786 | 118.4380 | .7 | 1432.0086 | 134.1460 |
| .8 | 844.9628 | 103.0442 | .8 | 1122.2083 | 118.7522 | .8 | 1438 7238 | 134.4602 |
| .9 | 850.1229 | 103.3584 | .9 | 1128.1538 | 119.0664 | .9 | 1445.4546 | 134.7743 |
| 33.0 | 855.2986 | 103.6726 | 38.0 | 1134.1149 | 119.3805 | 43.0 | 1452.2012 | 135.0885 |
| .1 | 860.4902 | 103.9867 | .1 | 1140.0918 | 119.6947 | .1 | 1458.9635 | 135.4026 |
| .2 | 865.6973 | 104.3009 | .2 | 1146.0844 | 120.0088 | .2 | 1465 7415 | 135.7168 |
| .3 | 870.9202 | 104.6150 | .3 | 1152.0927 | 120.3230 | .3 | 1472.5352 | 136.0310 |
| .4 | 876.1588 | 104.9292 | .4 | 1158.1167 | 120.6372 | .4 | 1479.3446 | 136.3451 |
| .5 | 881.4131 | 105.2434 | .5 | 1164.1564 | 120.9513 | .5 | 1486 1697 | 136.6593 |
| .6 | 886.6831 | 105.5575 | .6 | 1170.2118 | 121.2655 | .6 | 1493.0105 | 136.9734 |
| .7 | 891.9688 | 105.8717 | .7 | 1176.2830 | 121.5796 | .7 | 1499.8670 | 137.2876 |
| .8 | 897.2703 | 106.1858 | .8 | 1182.3698 | 121.8938 | .8 | 1506.7393 | 137.6018 |
| .9 | 902.5874 | 106.5000 | .9 | 1188.4724 | 122.2080 | .9 | 1513.6272 | 137.9159 |
| 34.0 | 907.9203 | 106.8142 | 39.0 | 1194.5906 | 122.5221 | 44.0 | 1520.5308 | 138.2301 |
| .1 | 913.2688 | 107.1283 | .1 | 1200.7246 | 122.8363 | .1 | 1527.4502 | 138.5442 |
| .2 | 918.6331 | 107.4425 | .2 | 1206.8742 | 123.1504 | .2 | 1534.3853 | 138.8584 |
| .3 | 924.0131 | 107.7566 | .3 | 1213.0396 | 123.4646 | .3 | 1541.3360 | 139.1726 |
| .4 | 929.4088 | 108.0708 | .4 | 1219.2207 | 123.7788 | .4 | 1548.3025 | 139.4867 |
| .5 | 934.8202 | 108.3849 | .5 | 1225.4175 | 124.0929 | .5 | 155 5.247 | 139.8009 |
| .6 | 940.2473 | 108.6991 | .6 | 1231.6300 | 124.4071 | .6 | 1562.2826 | 140.1153 |
| .7 | 945.6901 | 109.0133 | .7 | 1237.8582 | 124.7212 | .7 | 1569.2962 | 140.4292 |
| .8 | 951.1486 | 109.3274 | .8 | 1244.1021 | 125.0354 | .8 | 1576.3255 | 140.7434 |
| .9 | 956.6228 | 109.6416 | .9 | 1250.3617 | 125.3495 | .9 | 1583.3706 | 141.0575 |

## Table of Areas and Circumferences of Circles

### Areas and Circumferences of Circles (Continued)

Advancing by tenths

| Dia. | Area | Circum. | Dia. | Area | Circum. | Dia. | Area | Circum. |
|---|---|---|---|---|---|---|---|---|
| 45.0 | 1590.4313 | 141.3717 | 50.0 | 1963.4954 | 157.0796 | 55.0 | 2375.8294 | 172.7876 |
| .1 | 1597.5077 | 141.6858 | .1 | 1971.3572 | 157.3938 | .1 | 2384.4767 | 173.1017 |
| .2 | 1604.5999 | 142.0000 | .2 | 1979.2348 | 157.7080 | .2 | 2393.1396 | 173.4159 |
| .3 | 1611.7077 | 142.3142 | .3 | 1987.1280 | 158.0221 | .3 | 2401.8183 | 173.7301 |
| .4 | 1618.8313 | 142.6283 | .4 | 1995.0370 | 158.3363 | .4 | 2410.5126 | 174.0442 |
| .5 | 1625.9705 | 142.9425 | .5 | 2002.9617 | 158.6504 | .5 | 2419.2227 | 174.3584 |
| .6 | 1633.1255 | 143.2566 | .6 | 2010.9020 | 158.9646 | .6 | 2427.9485 | 174.6726 |
| .7 | 1640.2962 | 143.5708 | .7 | 2018.8581 | 159.2787 | .7 | 2436.6899 | 174.9867 |
| .8 | 1647.4826 | 143.8849 | .8 | 2026.8299 | 159.5929 | .8 | 2445.4471 | 175.3009 |
| .9 | 1654.6847 | 144.1991 | .9 | 2034.8174 | 159.9071 | .9 | 2454.2200 | 175.6150 |
| 46.0 | 1661.9025 | 144.5133 | 51.0 | 2042.8206 | 160.2212 | 56.0 | 2463.0086 | 175.9292 |
| .1 | 1669.1360 | 144.8274 | .1 | 2050.8395 | 160.5354 | .1 | 2471.8130 | 176.2433 |
| .2 | 1676.3853 | 145.1416 | .2 | 2058.8742 | 160.8495 | .2 | 2480.6330 | 176.5575 |
| .3 | 1683.6502 | 145.4557 | .3 | 2066.9245 | 161.1637 | .3 | 2489.4687 | 176.8717 |
| .4 | 1690.9308 | 145.7699 | .4 | 2074.9905 | 161.4779 | .4 | 2498.3201 | 177.1858 |
| .5 | 1698.2272 | 146.0841 | .5 | 2083.0723 | 161.7920 | .5 | 2507.1873 | 177.5000 |
| .6 | 1705.5392 | 146.3982 | .6 | 2091.1697 | 162.1062 | .6 | 2516.0701 | 177.8141 |
| .7 | 1712.8670 | 146.7124 | .7 | 2099.2829 | 162.4203 | .7 | 2524.9687 | 178.1283 |
| .8 | 1720.2105 | 147.0265 | .8 | 2107.4118 | 162.7345 | .8 | 2533.8830 | 178.4425 |
| .9 | 1727.5697 | 147.3407 | .9 | 2115.5563 | 163.0487 | .9 | 2542.8129 | 178.7566 |
| 47.0 | 1734.9445 | 147.6550 | 52.0 | 2123.7166 | 163.3628 | 57.0 | 2551.7586 | 179.0708 |
| .1 | 1742.3351 | 147.9690 | .1 | 2131.8926 | 163.6770 | .1 | 2560.7200 | 179.3849 |
| .2 | 1749.7414 | 148.2832 | .2 | 2140.0843 | 163.9911 | .2 | 2569.6971 | 179.6991 |
| .3 | 1757.1635 | 148.5973 | .3 | 2148.2917 | 164.3053 | .3 | 2578.6899 | 180.0133 |
| .4 | 1764.6012 | 148.9115 | .4 | 2156.5149 | 164.6195 | .4 | 2587.6985 | 180.3274 |
| .5 | 1772.0546 | 149.2257 | .5 | 2164.7537 | 164.9336 | .5 | 2596.7227 | 180.6416 |
| .6 | 1779.5237 | 149.5398 | .6 | 2173.0082 | 165.2479 | .6 | 2605.7626 | 180.9557 |
| .7 | 1787.0086 | 149.8540 | .7 | 2181.2785 | 165.5619 | .7 | 2614.8183 | 181.2699 |
| .8 | 1794.5091 | 150.1681 | .8 | 2189.5644 | 165.8761 | .8 | 2623.8896 | 181.5841 |
| .9 | 1802.0254 | 150.4823 | .9 | 2197.8661 | 166.1903 | .9 | 2632.9767 | 181.8982 |
| 48.0 | 1809.5574 | 150.7964 | 53.0 | 2206.1834 | 166.5044 | 58.0 | 2642.0794 | 182.2124 |
| .1 | 1817.1050 | 151.1106 | .1 | 2214.5165 | 166.8186 | .1 | 2651.1979 | 182.5265 |
| .2 | 1824.6684 | 151.4248 | .2 | 2222.8653 | 167.1327 | .2 | 2660.3321 | 182.8407 |
| .3 | 1832.2475 | 151.7389 | .3 | 2231.2298 | 167.4469 | .3 | 2669.4820 | 183.1549 |
| .4 | 1839.8423 | 152.0531 | .4 | 2239.6100 | 167.7610 | .4 | 2678.6476 | 183.4690 |
| .5 | 1847.4528 | 152.3672 | .5 | 2248.0059 | 168.0752 | .5 | 2687.8289 | 183.7832 |
| .6 | 1855.0790 | 152.6814 | .6 | 2256.4175 | 168.3894 | .6 | 2697.0259 | 184.0973 |
| .7 | 1862.7210 | 152.9956 | .7 | 2264.8448 | 168.7035 | .7 | 2706.2386 | 184.4115 |
| .8 | 1870.3786 | 153.3097 | .8 | 2273.2879 | 169.0177 | .8 | 2715.4670 | 184.7256 |
| .9 | 1878.0519 | 153.6239 | .9 | 2281.7466 | 169.3318 | .9 | 2724.7112 | 185.0398 |
| 49.0 | 1885.7409 | 153.9380 | 54.0 | 2290.2210 | 169.6460 | 59.0 | 2733.9710 | 185.3540 |
| .1 | 1893.4457 | 154.2522 | .1 | 2298.7112 | 169.9602 | .1 | 2743.2466 | 185.6681 |
| .2 | 1901.1662 | 154.5664 | .2 | 2307.2171 | 170.2743 | .2 | 2752.5378 | 185.9823 |
| .3 | 1908.9024 | 154.8805 | .3 | 2315.7386 | 170.5885 | .3 | 2761.8448 | 186.2964 |
| .4 | 1916.6543 | 155.1947 | .4 | 2324.2759 | 170.9026 | .4 | 2771.1675 | 186.6106 |
| .5 | 1924.4218 | 155.5088 | .5 | 2332.8289 | 171.2168 | .5 | 2780.5058 | 186.9248 |
| .6 | 1932.2051 | 155.8230 | .6 | 2341.3976 | 171.5310 | .6 | 2789.8599 | 187.2389 |
| .7 | 1940.0042 | 156.1372 | .7 | 2349.9820 | 171.8451 | .7 | 2799.2297 | 187.5531 |
| .8 | 1947.8189 | 156.4513 | .8 | 2358.5821 | 172.1593 | .8 | 2808.6152 | 187.8672 |
| .9 | 1955.6493 | 156.7655 | .9 | 2367.1979 | 172.4735 | .9 | 2818.0165 | 188.1814 |

**Areas and Circumferences of Circles (Continued)**

Advancing by tenths

| Dia. | Area | Circum. | Dia. | Area | Circum. | Dia. | Area | Circum. |
|---|---|---|---|---|---|---|---|---|
| 60.0 | 2827.4334 | 188.4956 | 65.0 | 3318.3072 | 204.2035 | 70.0 | 3848.4510 | 219.9115 |
| .1 | 2836.8660 | 188.8097 | .1 | 3328.5253 | 204.5176 | .1 | 3859.4544 | 220.2256 |
| .2 | 2846.3144 | 189.1239 | .2 | 3338.7590 | 204.8318 | .2 | 3870.4736 | 220.5398 |
| .3 | 2855.7784 | 189.4380 | .3 | 3349.0085 | 205.1460 | .3 | 3881.5084 | 220.8540 |
| .4 | 2865.2582 | 189.7522 | .4 | 3359.2736 | 205.4602 | .4 | 3892.5590 | 221.1681 |
| .5 | 2874.7536 | 190.0664 | .5 | 3369.5545 | 205.7743 | .5 | 3903.6252 | 221.4823 |
| .6 | 2884.2648 | 190.3805 | .6 | 3379.8510 | 206.0885 | .6 | 3914.7072 | 221.7964 |
| .7 | 2893.7917 | 190.6947 | .7 | 3390.1633 | 206.4026 | .7 | 3925.8049 | 222.1106 |
| .8 | 2903.3343 | 191.0088 | .8 | 3400.4913 | 206.7168 | .8 | 3936.9182 | 222.4248 |
| .9 | 2912.8926 | 191.3230 | .9 | 3410.8350 | 207.0310 | .9 | 3948.0473 | 222.7389 |
| 61.0 | 2922.4666 | 191.6372 | 66.0 | 3421.1944 | 207.3451 | 71.0 | 3959.1921 | 223.0531 |
| .1 | 2932.0563 | 191.9513 | .1 | 3431.5695 | 207.6593 | .1 | 3970.3526 | 223.3672 |
| .2 | 2941.6617 | 192.2655 | .2 | 3441.9603 | 207.9734 | .2 | 3981.5289 | 223.6814 |
| .3 | 2951.2828 | 192.5796 | .3 | 3452.3669 | 208.2876 | .3 | 3992.7208 | 223.9956 |
| .4 | 2960.9197 | 192.8938 | .4 | 3462.7891 | 208.6017 | .4 | 4003.9284 | 224.3097 |
| .5 | 2970.5722 | 193.2079 | .5 | 3473.2270 | 208.9159 | .5 | 4015.1518 | 224.6239 |
| .6 | 2980.2405 | 193.5221 | .6 | 3483.6807 | 209.2301 | .6 | 4026.3908 | 224.9380 |
| .7 | 2989.9244 | 193.8363 | .7 | 3494.1500 | 209.5442 | .7 | 4037.6456 | 225.2522 |
| .8 | 2999.6241 | 194.1504 | .8 | 3504.6351 | 209.8584 | .8 | 4048.9160 | 225.5664 |
| .9 | 3009.3395 | 194.4646 | .9 | 3515.1359 | 210.1725 | .9 | 4060.2022 | 225.3805 |
| 62.0 | 3019.0705 | 194.7787 | 67.0 | 3525.6524 | 210.4867 | 72.0 | 4071.5041 | 226.1947 |
| .1 | 3028.8173 | 195.0929 | .1 | 3536.1845 | 210.8009 | .1 | 4082.8217 | 226.5088 |
| .2 | 3038.5798 | 195.4071 | .2 | 3546.7324 | 211.1150 | .2 | 4094.1550 | 226.8230 |
| .3 | 3048.3580 | 195.7212 | .3 | 3557.2960 | 211.4292 | .3 | 4105.5040 | 227.1371 |
| .4 | 3058.1520 | 196.0354 | .4 | 3567.8754 | 211.7433 | .4 | 4116.8687 | 227.4513 |
| .5 | 3067.9616 | 196.3495 | .5 | 3578.4704 | 212.0575 | .5 | 4128.2491 | 227.7655 |
| .6 | 3077.7869 | 196.6637 | .6 | 3589.0811 | 212.3717 | .6 | 4139.6452 | 228.0796 |
| .7 | 3087.6279 | 196.9779 | .7 | 3599.7075 | 212.6858 | .7 | 4151.0571 | 228.3938 |
| .8 | 3097.4847 | 197.2920 | .8 | 3610.3497 | 213.0000 | .8 | 4162.4846 | 228.7079 |
| .9 | 3107.3571 | 197.6062 | .9 | 3621.0075 | 213.3141 | .9 | 4173.9279 | 229.0221 |
| 63.0 | 3117.2453 | 197.9203 | 68.0 | 3631.6811 | 213.6283 | 73.0 | 4185.3868 | 229.3363 |
| .1 | 3127.1492 | 198.2345 | .1 | 3642.3704 | 213.9425 | .1 | 4196.8615 | 229.6504 |
| .2 | 3137.0688 | 198.5487 | .2 | 3653.0754 | 214.2566 | .2 | 4208.3519 | 229.9646 |
| .3 | 3147.0040 | 198.8628 | .3 | 3663.7960 | 214.5708 | .3 | 4219.8579 | 230.2787 |
| .4 | 3156.9550 | 199.1770 | .4 | 3674.5324 | 214.8849 | .4 | 4231.3797 | 230.5929 |
| .5 | 3166.9217 | 199.4911 | .5 | 3685.2845 | 215.1991 | .5 | 4242.9172 | 230.9071 |
| .6 | 3176.9043 | 199.8053 | .6 | 3696.0523 | 215.5133 | .6 | 4254.4704 | 231.2212 |
| .7 | 3186.9023 | 200.1195 | .7 | 3706.8359 | 215.8274 | .7 | 4266.0394 | 231.5354 |
| .8 | 3196.9161 | 200.4336 | .8 | 3717.6351 | 216.1416 | .8 | 4277.6240 | 231.8495 |
| .9 | 3206.9456 | 200.7478 | .9 | 3728.4500 | 216.4556 | .9 | 4289.2243 | 232.1637 |
| 64.0 | 3216.9909 | 201.0620 | 69.0 | 3739.2807 | 216.7699 | 74.0 | 4300.8403 | 232.4779 |
| .1 | 3227.0518 | 201.3761 | .1 | 3750.1270 | 217.0841 | .1 | 4312.4721 | 232.7920 |
| .2 | 3237.1285 | 201.6902 | .2 | 3760.9891 | 217.3982 | .2 | 4324.1195 | 233.1062 |
| .3 | 3247.2222 | 202.0044 | .3 | 3771.8668 | 217.7124 | .3 | 4335.7827 | 233.4203 |
| .4 | 3257.3289 | 202.3186 | .4 | 3782.7603 | 218.0265 | .4 | 4347.4616 | 233.7345 |
| .5 | 3267.4527 | 202.6327 | .5 | 3793.6695 | 218.3407 | .5 | 4359.1562 | 234.0487 |
| .6 | 3277.5922 | 202.9469 | .6 | 3804.5944 | 218.6548 | .6 | 4370.8664 | 234.3628 |
| .7 | 3287.7474 | 203.2610 | .7 | 3815.5350 | 218.9690 | .7 | 4382.5924 | 234.6770 |
| .8 | 3297.9183 | 203.5752 | .8 | 3826.4913 | 219.2832 | .8 | 4394.3341 | 234.9911 |
| .9 | 3308.1049 | 203.8894 | .9 | 3837.4633 | 219.5973 | .9 | 4406.0916 | 235.3053 |

## Table of Areas and Circumferences of Circles

### Areas and Circumferences of Circles (Continued)

Advancing by tenths

| Dia. | Area | Circum. | Dia. | Area | Circum. | Dia. | Area | Circum. |
|---|---|---|---|---|---|---|---|---|
| 75.0 | 4417.8647 | 235.6194 | 80.0 | 5026.5482 | 251.3274 | 85.0 | 5674.5017 | 267.0354 |
| .1 | 4429.6535 | 235.9336 | .1 | 5039.1225 | 251.6416 | .1 | 5687.8614 | 267.3495 |
| .2 | 4441.4580 | 236.2478 | .2 | 5051.7124 | 251.9557 | .2 | 5701.2367 | 267.6637 |
| .3 | 4453.2783 | 236.5619 | .3 | 5064.3180 | 252.2699 | .3 | 5714.6277 | 267.9779 |
| .4 | 4465.1142 | 236.8761 | .4 | 5076.9394 | 252.5840 | .4 | 5728.0345 | 268.2920 |
| .5 | 4476.9659 | 237.1902 | .5 | 5089.5764 | 252.8982 | .5 | 5741.4569 | 268.6062 |
| .6 | 4488.8332 | 237.5044 | .6 | 5102.2292 | 253.2124 | .6 | 5754.8951 | 268.9203 |
| .7 | 4500.7163 | 237.8186 | .7 | 5114.8977 | 253.5265 | .7 | 5768.3490 | 269.2345 |
| .8 | 4512.6151 | 238.1327 | .8 | 5127.5819 | 253.8407 | .8 | 5781.8185 | 269.5486 |
| .9 | 4524.5290 | 238.4469 | .9 | 5140.2818 | 254.1548 | .9 | 5795.3038 | 269.8628 |
| 76.0 | 4536.4598 | 238.7610 | 81.0 | 5152.9973 | 254.4690 | 86.0 | 5808.8048 | 270.1770 |
| .1 | 4548.4057 | 239.0752 | .1 | 5165.7287 | 254.7832 | .1 | 5822.3215 | 270.4911 |
| .2 | 4560.3673 | 239.3894 | .2 | 5178.4757 | 255.0973 | .2 | 5835.8539 | 270.8053 |
| .3 | 4572.3446 | 239.7035 | .3 | 5191.2384 | 255.4115 | .3 | 5849.4020 | 271.1194 |
| .4 | 4584.3377 | 240.0177 | .4 | 5204.0168 | 255.7256 | .4 | 5862.9659 | 271.4336 |
| .5 | 4596.3464 | 240.3318 | .5 | 5216.8110 | 256.0398 | .5 | 5876.5454 | 271.7478 |
| .6 | 4608.3708 | 240.6460 | .6 | 5229.6208 | 256.3540 | .6 | 5890.1407 | 272.0619 |
| .7 | 4620.4110 | 240.9602 | .7 | 5242.4463 | 256.6681 | .7 | 5903.7516 | 272.3761 |
| .8 | 4632.4669 | 241.2743 | .8 | 5255.2876 | 256.9823 | .8 | 5917.3783 | 272.6902 |
| .9 | 4644.5384 | 241.5885 | .9 | 5268.1446 | 257.2966 | .9 | 5931.0206 | 273.0044 |
| 77.0 | 4656.6257 | 241.9026 | 82.0 | 5281.0173 | 257.6106 | 87.0 | 5944.6787 | 273.3186 |
| .1 | 4668.7287 | 242.2168 | .1 | 5293.9056 | 257.9247 | .1 | 5958.3525 | 273.6327 |
| .2 | 4680.8474 | 242.5310 | .2 | 5306.8097 | 258.2389 | .2 | 5972.0420 | 273.9469 |
| .3 | 4692.9818 | 242.8451 | .3 | 5319.7295 | 258.5531 | .3 | 5985.7472 | 274.2610 |
| .4 | 4705.1319 | 243.1592 | .4 | 5332.6650 | 258.8672 | .4 | 5999.4681 | 274.5752 |
| .5 | 4717.2977 | 243.4734 | .5 | 5345.6162 | 259.1814 | .5 | 6013.2047 | 274.8894 |
| .6 | 4729.4792 | 243.7876 | .6 | 5358.5832 | 259.4956 | .6 | 6026.9570 | 275.2035 |
| .7 | 4741.6765 | 244.1017 | .7 | 5371.5658 | 259.8097 | .7 | 6040.7250 | 275.5177 |
| .8 | 4753.8894 | 244.4159 | .8 | 5384.5641 | 260.1239 | .8 | 6054.5088 | 275.8318 |
| .9 | 4766.1181 | 244.7301 | .9 | 5397.5782 | 260.4380 | .9 | 6068.3082 | 276.1460 |
| 78.0 | 4778.3624 | 245.0442 | 83.0 | 5410.6079 | 260.7522 | 88.0 | 6082.1234 | 276.4602 |
| .1 | 4790.6225 | 245.3584 | .1 | 5423.6534 | 261.0663 | .1 | 6095.9542 | 276.7743 |
| .2 | 4802.8983 | 245.6725 | .2 | 5436.7146 | 261.3805 | .2 | 6109.8008 | 277.0885 |
| .3 | 4815.1897 | 245.9867 | .3 | 5449.7915 | 261.6947 | .3 | 6123.6631 | 277.4026 |
| .4 | 4827.4969 | 246.3009 | .4 | 5462.8840 | 262.0088 | .4 | 6137.5411 | 277.7168 |
| .5 | 4839.8198 | 246.6150 | .5 | 5475.9923 | 262.3230 | .5 | 6151.4348 | 278.0309 |
| .6 | 4852.1584 | 246.9292 | .6 | 5489.1163 | 262.6371 | .6 | 6165.3442 | 278.3451 |
| .7 | 4864.5128 | 247.2433 | .7 | 5502.2561 | 262.9513 | .7 | 6179.2693 | 278.6593 |
| .8 | 4876.8828 | 247.5575 | .8 | 5515.4115 | 263.2655 | .8 | 6193.2101 | 278.9740 |
| .9 | 4889.2685 | 247.8717 | .9 | 5528.5826 | 263.5796 | .9 | 6207.1666 | 279.2876 |
| 79.0 | 4901.6699 | 248.1858 | 84.0 | 5541.7694 | 263.8938 | 89.0 | 6221.1389 | 279.6017 |
| .1 | 4914.0871 | 248.5000 | .1 | 5554.9720 | 264.2079 | .1 | 6235.1268 | 279.9159 |
| .2 | 4926.5199 | 248.8141 | .2 | 5568.1902 | 264.5221 | .2 | 6249.1304 | 280.2301 |
| .3 | 4938.9685 | 249.1283 | .3 | 5581.4242 | 264.8363 | .3 | 6263.1498 | 280.5442 |
| .4 | 4951.4328 | 249.4425 | .4 | 5594.6739 | 265.1514 | .4 | 6277.1849 | 280.8584 |
| .5 | 4963.9127 | 249.7566 | .5 | 5607.9392 | 265.4646 | .5 | 6291.2356 | 281.1725 |
| .6 | 4976.4084 | 250.0708 | .6 | 5621.2203 | 265.7787 | .6 | 6305.3021 | 281.4867 |
| .7 | 4988.9198 | 250.3850 | .7 | 5634.5171 | 266.0929 | .7 | 6319.3843 | 281.8009 |
| .8 | 5001.4469 | 250.6991 | .8 | 5647.8296 | 266.4071 | .8 | 6333.4822 | 282.1150 |
| .9 | 5013.9897 | 251.0133 | .9 | 5661.1578 | 266.7212 | .9 | 6347.5958 | 282.4292 |

## Geometry and Mensuration

### Areas and Circumferences of Circles (Continued)

Advancing by tenths

| Dia. | Area | Circum. | Dia. | Area | Circum. | Dia. | Area | Circum. |
|---|---|---|---|---|---|---|---|---|
| 90.0 | 6361.7251 | 282.7433 | 93.5 | 6866.1471 | 293.7389 | 97.0 | 7389.8113 | 304.7345 |
| .1 | 6375.8701 | 283.0575 | .6 | 6880.8419 | 294.0531 | .1 | 7405.0559 | 305.0486 |
| .2 | 6390.0309 | 283.3717 | .7 | 6895.5524 | 294.3672 | .2 | 7420.3162 | 305.3628 |
| .3 | 6404.2073 | 283.6858 | .8 | 6910.2786 | 294.6814 | .3 | 7435.5922 | 305.6770 |
| .4 | 6418.3995 | 284.0000 | .9 | 6925.0205 | 294.9956 | .4 | 7450.8839 | 305.9911 |
| .5 | 6432.6073 | 284.3141 | 94.0 | 6939.7782 | 295.3097 | .5 | 7466.1913 | 306.3053 |
| .6 | 6446.8309 | 284.6283 | .1 | 6954.5515 | 295.6239 | .6 | 7481.5144 | 306.6194 |
| .7 | 6461.0701 | 284.9425 | .2 | 6969.3106 | 295.9380 | .7 | 7496.8532 | 306.9336 |
| .8 | 6475.3251 | 285.2566 | .3 | 6984.1453 | 296.2522 | .8 | 7512.2078 | 307.2478 |
| .9 | 6489.5958 | 285.5708 | .4 | 6998.9658 | 296.5663 | .9 | 7527.5780 | 307.5619 |
| 91.0 | 6503.8822 | 285.8849 | .5 | 7013.8019 | 296.8805 | 98.0 | 7542.9640 | 307.8761 |
| .1 | 6518.1843 | 286.1991 | .6 | 7028.6538 | 297.1947 | .1 | 7558.3656 | 308.1902 |
| .2 | 6532.5021 | 286.5133 | .7 | 7043.5214 | 297.5088 | .2 | 7573.7830 | 308.5044 |
| .3 | 6546.8356 | 286.8274 | .8 | 7058.4047 | 297.8230 | .3 | 7589.2161 | 308.8186 |
| .4 | 6561.1848 | 287.1416 | .9 | 7073.3033 | 298.1371 | .4 | 7604.6648 | 309.1327 |
| .5 | 6575.5498 | 287.4557 | 95.0 | 7088.2184 | 298.4513 | .5 | 7620.1293 | 309.4469 |
| .6 | 6589.9304 | 287.7699 | .1 | 7103.1488 | 298.7655 | .6 | 7635.6095 | 309.7610 |
| .7 | 6604.3268 | 288.0840 | .2 | 7118.1950 | 299.0796 | .7 | 7651.1054 | 310.0752 |
| .8 | 6618.7388 | 288.3982 | .3 | 7133.0568 | 299.3938 | .8 | 7666.6170 | 310.3894 |
| .9 | 6633.1666 | 288.7124 | .4 | 7148.0343 | 299.7079 | .9 | 7682.1444 | 310.7035 |
| 92.0 | 6647.6101 | 289.0265 | .5 | 7163.0276 | 300.0221 | 99.0 | 7697.6893 | 311.0177 |
| .1 | 6662.0692 | 289.3407 | .6 | 7178.0366 | 300.3363 | .1 | 7713.2461 | 311.3318 |
| .2 | 6676.5441 | 289.6548 | .7 | 7193.0612 | 300.6504 | .2 | 7728.8206 | 311.6460 |
| .3 | 6691.0347 | 289.9690 | .8 | 7208.1016 | 300.9646 | .3 | 7744.4107 | 311.9602 |
| .4 | 6705.5410 | 290.2832 | .9 | 7223.1577 | 301.2787 | .4 | 7760.0166 | 312.2743 |
| .5 | 6720.0630 | 290.5973 | 96.0 | 7238.2295 | 301.5929 | .5 | 7775.6382 | 312.5885 |
| .6 | 6734.6008 | 290.9115 | .1 | 7253.3170 | 301.9071 | .6 | 7791.2754 | 312.9026 |
| .7 | 6749.1542 | 291.2256 | .2 | 7268.4202 | 302.2212 | .7 | 7806.9284 | 313.2168 |
| .8 | 6763.7233 | 291.5398 | .3 | 7283.5391 | 302.5354 | .8 | 7822.5971 | 313.5309 |
| .9 | 6778.3082 | 291.8540 | .4 | 7298.6737 | 302.8405 | .9 | 7838.2815 | 313.8451 |
| 93.0 | 6792.9087 | 292.1681 | .5 | 7313.8240 | 303.1637 | 100.0 | 7853.9816 | 314.1593 |
| .1 | 6807.5250 | 292.4823 | .6 | 7328.9901 | 303.4779 | | | |
| .2 | 6822.1569 | 292.7964 | .7 | 7344.1718 | 303.7920 | | | |
| .3 | 6836.8046 | 293.1106 | .8 | 7359.3693 | 304.1062 | | | |
| .4 | 6851.4680 | 293.4248 | .9 | 7374.5824 | 304.4203 | | | |

## Table of Areas and Circumferences of Circles

### Areas of Circles

Advancing by eighths

AREAS

| Dia. | 0.0 | 0.$\frac{1}{8}$ | 0.$\frac{1}{4}$ | 0.$\frac{3}{8}$ | 0.$\frac{1}{2}$ | 0.$\frac{5}{8}$ | 0.$\frac{3}{4}$ | 0.$\frac{7}{8}$ |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 0.0122 | 0.0490 | 0.1104 | 0.1963 | 0.3068 | 0.4417 | 0.6013 |
| 1 | 0.7854 | 0.9940 | 1.227 | 1.484 | 1.767 | 2.073 | 2.405 | 2.761 |
| 2 | 3.1416 | 3.546 | 3.976 | 4.430 | 4.908 | 5.411 | 5.939 | 6.491 |
| 3 | 7.068 | 7.669 | 8.295 | 8.946 | 9.621 | 10.32 | 11.04 | 11.79 |
| 4 | 12.56 | 13.36 | 14.18 | 15.03 | 15.90 | 16.80 | 17.72 | 18.66 |
| 5 | 19.63 | 20.62 | 21.64 | 22.69 | 23.75 | 24.85 | 25.96 | 27.10 |
| 6 | 28.27 | 29.46 | 30.67 | 31.91 | 33.18 | 34.47 | 35.78 | 37.12 |
| 7 | 38.48 | 39.87 | 41.28 | 42.71 | 44.17 | 45.66 | 47.17 | 48.70 |
| 8 | 50.26 | 51.84 | 53.45 | 55.08 | 56.74 | 58.42 | 60.13 | 61.86 |
| 9 | 63.61 | 65.39 | 67.20 | 69.02 | 70.88 | 72.75 | 74.66 | 76.58 |
| 10 | 78.54 | 80.51 | 82.51 | 84.54 | 86.59 | 88.66 | 90.76 | 92.88 |
| 11 | 95.03 | 97.20 | 99.40 | 101.6 | 103.8 | 106.1 | 108.4 | 110.7 |
| 12 | 113.0 | 115.4 | 117.8 | 120.2 | 122.7 | 125.1 | 127.6 | 130.1 |
| 13 | 132.7 | 135.2 | 137.8 | 140.5 | 143.1 | 145.8 | 148.4 | 151.2 |
| 14 | 153.9 | 156.6 | 159.4 | 162.2 | 165.1 | 167.9 | 170.8 | 173.7 |
| 15 | 176.7 | 179.6 | 182.6 | 185.6 | 188.6 | 191.7 | 194.8 | 197.9 |
| 16 | 201.0 | 204.2 | 207.3 | 210.5 | 213.8 | 217.0 | 220.3 | 223.6 |
| 17 | 226.9 | 230.3 | 233.7 | 237.1 | 240.5 | 243.9 | 247.4 | 250.9 |
| 18 | 254.4 | 258.0 | 261.5 | 265.1 | 268.8 | 272.4 | 276.1 | 279.8 |
| 19 | 283.5 | 287.2 | 291.0 | 294.8 | 298.6 | 302.4 | 306.3 | 310.2 |
| 20 | 314.1 | 318.1 | 322.0 | 326.0 | 330.0 | 334.1 | 338.1 | 342.2 |
| 21 | 346.3 | 350.4 | 354.6 | 358.8 | 363.0 | 367.2 | 371.5 | 375.8 |
| 22 | 380.1 | 384.4 | 388.8 | 393.2 | 397.6 | 402.0 | 406.4 | 410.9 |
| 23 | 415.4 | 420.0 | 424.5 | 429.1 | 433.7 | 438.3 | 443.0 | 447.6 |
| 24 | 452.3 | 457.1 | 461.8 | 466.6 | 471.4 | 476.2 | 481.1 | 485.9 |
| 25 | 490.8 | 495.7 | 500.7 | 505.7 | 510.7 | 515.7 | 520.7 | 525.8 |
| 26 | 530.9 | 536.0 | 541.1 | 546.3 | 551.5 | 556.7 | 562.0 | 567.2 |
| 27 | 572.5 | 577.8 | 583.2 | 588.5 | 593.9 | 599.3 | 604.8 | 610.2 |
| 28 | 615.7 | 621.2 | 626.7 | 632.3 | 637.9 | 643.5 | 649.1 | 654.8 |
| 29 | 660.5 | 666.2 | 671.9 | 677.7 | 683.4 | 689.2 | 695.1 | 700.9 |
| 30 | 706.3 | 712.7 | 718.6 | 724.6 | 730.6 | 736.6 | 742.6 | 748.6 |
| 31 | 754.8 | 760.9 | 767.0 | 773.1 | 779.3 | 785.5 | 791.7 | 798.0 |
| 32 | 804.3 | 810.6 | 816.9 | 823.2 | 829.6 | 836.0 | 842.4 | 848.8 |
| 33 | 855.3 | 861.8 | 868.3 | 874.9 | 881.4 | 888.0 | 894.6 | 901.3 |
| 34 | 907.9 | 914.7 | 921.3 | 928.1 | 934.8 | 941.6 | 948.4 | 955.3 |
| 35 | 962.1 | 969.0 | 975.9 | 982.8 | 989.8 | 996.8 | 1003.8 | 1010.8 |
| 36 | 1017.9 | 1025.0 | 1032.1 | 1039.2 | 1046.3 | 1053.5 | 1060.7 | 1068.0 |
| 37 | 1075.2 | 1082.5 | 1089.8 | 1097.1 | 1104.5 | 1111.8 | 1119.2 | 1126.7 |
| 38 | 1134.1 | 1141.6 | 1149.1 | 1156.6 | 1164.2 | 1171.7 | 1179.3 | 1186.9 |
| 39 | 1194.6 | 1202.3 | 1210.0 | 1217.7 | 1225.4 | 1233.2 | 1241.0 | 1248.8 |
| 40 | 1256.6 | 1264.5 | 1272.4 | 1280.3 | 1288.2 | 1296.2 | 1304.2 | 1312.2 |
| 41 | 1320.3 | 1328.3 | 1336.4 | 1344.5 | 1352.7 | 1360.8 | 1369.0 | 1377.2 |
| 42 | 1385.4 | 1393.7 | 1402.0 | 1410.3 | 1418.6 | 1427.0 | 1435.4 | 1443.8 |
| 43 | 1452.2 | 1460.7 | 1469.1 | 1477.6 | 1486.2 | 1494.7 | 1503.3 | 1511.9 |
| 44 | 1520.5 | 1529.2 | 1537.9 | 1546.6 | 1555.3 | 1564.0 | 1572.8 | 1581.6 |
| 45 | 1590.4 | 1599.3 | 1608.2 | 1617.0 | 1626.0 | 1634.9 | 1643.9 | 1652.9 |

## Circumferences of Circles

Advancing by eighths

CIRCUMFERENCES

| Dia. | 0.0 | 0.$\frac{1}{8}$ | 0.$\frac{1}{4}$ | 0.$\frac{3}{8}$ | 0.$\frac{1}{2}$ | 0.$\frac{5}{8}$ | 0.$\frac{3}{4}$ | 0.$\frac{7}{8}$ |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.0 | 0.3927 | 0.7854 | 1.178 | 1.570 | 1.963 | 2.356 | 2.748 |
| 1 | 3.141 | 3.534 | 3.927 | 4.319 | 4.712 | 5.105 | 5.497 | 5.890 |
| 2 | 6.283 | 6.675 | 7.068 | 7.461 | 7.854 | 8.246 | 8.639 | 9.032 |
| 3 | 9.424 | 9.817 | 10.21 | 10.60 | 10.99 | 11.38 | 11.78 | 12.17 |
| 4 | 12.56 | 12.95 | 13.35 | 13.74 | 14.13 | 14.52 | 14.92 | 15.31 |
| 5 | 15.70 | 16.10 | 16.49 | 16.88 | 17.27 | 17.67 | 18.06 | 18.45 |
| 6 | 18.84 | 19.24 | 19.63 | 20.02 | 20.42 | 20.81 | 21.20 | 21.59 |
| 7 | 21.99 | 22.38 | 22.77 | 23.16 | 23.56 | 23.95 | 24.34 | 24.74 |
| 8 | 25.13 | 25.52 | 25.91 | 26.31 | 26.70 | 27.09 | 27.48 | 27.88 |
| 9 | 28.27 | 28.66 | 29.05 | 29.45 | 29.84 | 30.23 | 30.63 | 31.02 |
| 10 | 31.41 | 31.80 | 32.20 | 32.59 | 32.98 | 33.37 | 33.77 | 34.16 |
| 11 | 34.55 | 34.95 | 35.34 | 35.73 | 36.12 | 36.52 | 36.91 | 37.30 |
| 12 | 37.69 | 38.09 | 38.48 | 38.87 | 39.27 | 39.66 | 40.05 | 40.44 |
| 13 | 40.84 | 41.23 | 41.62 | 42.01 | 42.41 | 42.80 | 43.19 | 43.58 |
| 14 | 43.98 | 44.37 | 44.76 | 45.16 | 45.55 | 45.94 | 46.33 | 46.73 |
| 15 | 47.12 | 47.51 | 47.90 | 48.30 | 48.69 | 49.08 | 49.48 | 49.87 |
| 16 | 50.26 | 50.65 | 51.05 | 51.44 | 51.83 | 52.22 | 52.62 | 53.01 |
| 17 | 53.40 | 53.79 | 54.19 | 54.58 | 54.97 | 55.37 | 55.76 | 56.15 |
| 18 | 56.54 | 56.94 | 57.33 | 57.72 | 58.11 | 58.51 | 58.90 | 59.29 |
| 19 | 59.69 | 60.08 | 60.47 | 60.86 | 61.26 | 61.65 | 62.04 | 62.43 |
| 20 | 62.83 | 63.22 | 63.61 | 64.01 | 64.40 | 64.79 | 65.18 | 65.58 |
| 21 | 65.97 | 66.36 | 66.75 | 67.15 | 67.54 | 67.93 | 68.32 | 68.72 |
| 22 | 69.11 | 69.50 | 69.90 | 70.29 | 70.68 | 71.07 | 71.47 | 71.86 |
| 23 | 72.25 | 72.64 | 73.01 | 73.43 | 73.82 | 74.22 | 74.61 | 75.00 |
| 24 | 75.39 | 75.79 | 76.18 | 76.57 | 76.96 | 77.36 | 77.75 | 78.14 |
| 25 | 78.54 | 78.93 | 79.32 | 79.71 | 80.10 | 80.50 | 80.89 | 81.28 |
| 26 | 81.68 | 82.07 | 82.46 | 82.85 | 83.25 | 83.64 | 84.03 | 84.43 |
| 27 | 84.82 | 85.21 | 85.60 | 86.00 | 86.39 | 86.78 | 87.17 | 87.57 |
| 28 | 87.96 | 88.35 | 88.75 | 89.14 | 89.53 | 89.92 | 90.32 | 90.71 |
| 29 | 91.10 | 91.49 | 91.89 | 92.28 | 92.67 | 93.06 | 93.46 | 93.85 |
| 30 | 94.24 | 94.64 | 95.03 | 95.42 | 95.81 | 96.21 | 96.60 | 96.99 |
| 31 | 97.39 | 97.78 | 98.17 | 98.57 | 98.96 | 99.35 | 99.75 | 100.14 |
| 32 | 100.53 | 100.92 | 101.32 | 101.71 | 102.10 | 102.49 | 102.89 | 103.29 |
| 33 | 103.67 | 104.07 | 104.46 | 104.85 | 105.24 | 105.64 | 106.03 | 106.42 |
| 34 | 106.81 | 107.21 | 107.60 | 107.99 | 108.39 | 108.78 | 109.17 | 109.56 |
| 35 | 109.96 | 110.35 | 110.74 | 111.13 | 111.53 | 111.92 | 112.31 | 112.71 |
| 36 | 113.10 | 113.49 | 113.88 | 114.28 | 114.67 | 115.06 | 115.45 | 115.85 |
| 37 | 116.24 | 116.63 | 117.02 | 117.42 | 117.81 | 118.20 | 118.60 | 118.99 |
| 38 | 119.38 | 119.77 | 120.17 | 120.56 | 120.95 | 121.34 | 121.74 | 122.13 |
| 39 | 122.52 | 122.92 | 123.31 | 123.70 | 124.09 | 124.49 | 124.88 | 125.27 |
| 40 | 125.66 | 126.06 | 126.45 | 126.84 | 127.24 | 127.63 | 128.02 | 128.41 |
| 41 | 128.81 | 129.20 | 129.59 | 129.98 | 130.38 | 130.77 | 131.16 | 131.55 |
| 42 | 131.95 | 132.34 | 132.73 | 133.13 | 133.52 | 133.91 | 134.30 | 134.70 |
| 43 | 135.09 | 135.48 | 135.87 | 136.27 | 136.66 | 137.05 | 137.45 | 137.84 |
| 44 | 138.23 | 138.62 | 139.02 | 139.41 | 139.80 | 140.19 | 140.59 | 140.98 |
| 45 | 141.37 | 141.76 | 142.16 | 142.55 | 142 94 | 143.34 | 143.73 | 144.12 |

# Table of Areas and Circumferences of Circles

## Areas and Circumferences of Circles

FROM 1 TO 50 FEET

Advancing by one inch

| Diam., ft in | Area, sq ft | Circum., ft in | Diam., ft in | Area, sq ft | Circum., ft in | Diam., ft in | Area, sq ft | Circum., ft in |
|---|---|---|---|---|---|---|---|---|
| 1 0 | 0 7854 | 3 1⅝ | 5 0 | 19.635 | 15 8½ | 9 0 | 63.6174 | 28 3¼ |
| 1 | 0 9217 | 3 4⅝ | 1 | 20.2947 | 15 11⅝ | 1 | 64.8006 | 28 6⅜ |
| 2 | 1 069 | 3 8 | 2 | 20 9656 | 16 2¾ | 2 | 65.9951 | 28 9½ |
| 3 | 1 2271 | 3 11 | 3 | 21.6475 | 16 5¾ | 3 | 67.2007 | 29 ⅝ |
| 4 | 1 3962 | 4 2⅛ | 4 | 22.34 | 16 9 | 4 | 68.4166 | 29 3¾ |
| 5 | 1 5761 | 4 5⅜ | 5 | 23.0437 | 17 ⅛ | 5 | 69.644 | 29 7 |
| 6 | 1 7671 | 4 8½ | 6 | 23.7583 | 17 3¼ | 6 | 70.8823 | 29 10⅛ |
| 7 | 1 9683 | 4 11⅝ | 7 | 24.4835 | 17 6⅜ | 7 | 72.1309 | 30 1¼ |
| 8 | 2 1816 | 5 2¾ | 8 | 25.2199 | 17 9⅝ | 8 | 73.391 | 30 4⅜ |
| 9 | 2 4052 | 5 5⅞ | 9 | 25.9672 | 18 ¾ | 9 | 74.662 | 30 7½ |
| 10 | 2 6398 | 5 9 | 10 | 26.7251 | 18 3⅞ | 10 | 75.9433 | 30 11⅝ |
| 11 | 2 8852 | 6 ¼ | 11 | 27.4943 | 18 7⅛ | 11 | 77.2362 | 31 1¾ |
| 2 0 | 3 1416 | 6 3⅜ | 6 0 | 28.2744 | 18 10⅛ | 10 0 | 78.54 | 31 5 |
| 1 | 3 4087 | 6 6½ | 1 | 29.0649 | 19 1¼ | 1 | 79.854 | 31 8⅛ |
| 2 | 3 6869 | 6 9⅝ | 2 | 29.8668 | 19 4⅜ | 2 | 81.1795 | 31 11¼ |
| 3 | 3 976 | 7 ¾ | 3 | 30.6796 | 19 7½ | 3 | 82.516 | 32 2⅜ |
| 4 | 4.276 | 7 3⅞ | 4 | 31.5029 | 19 10⅝ | 4 | 83.8627 | 32 5½ |
| 5 | 4.5869 | 7 7 | 5 | 32.3376 | 20 1⅞ | 5 | 85.2211 | 32 8⅝ |
| 6 | 4.9087 | 7 10¼ | 6 | 33.1831 | 20 4⅞ | 6 | 86.5903 | 32 11¾ |
| 7 | 5.2413 | 8 1⅜ | 7 | 34.0391 | 20 8⅛ | 7 | 87.9697 | 33 2⅞ |
| 8 | 5.585 | 8 4½ | 8 | 34.9065 | 20 11¼ | 8 | 89.3608 | 33 6⅛ |
| 9 | 5.9395 | 8 7⅝ | 9 | 35.7847 | 21 2⅜ | 9 | 90.7627 | 33 9¼ |
| 10 | 6.3049 | 8 10¾ | 10 | 36.6735 | 21 5½ | 10 | 92.1749 | 34 ⅜ |
| 11 | 6.6813 | 9 1⅞ | 11 | 37.5736 | 21 8¾ | 11 | 93.5986 | 34 3½ |
| 3 0 | 7.0686 | 9 5 | 7 0 | 38.4846 | 21 11⅞ | 11 0 | 95.0334 | 34 6⅝ |
| 1 | 7 4666 | 9 8¼ | 1 | 39.406 | 22 3 | 1 | 96.4783 | 34 9¾ |
| 2 | 7.8757 | 9 11⅜ | 2 | 40.3388 | 22 6⅛ | 2 | 97.9347 | 35 ⅞ |
| 3 | 8.2957 | 10 2½ | 3 | 41.2825 | 22 9¼ | 3 | 99.4021 | 35 4⅛ |
| 4 | 8.7265 | 10 5⅝ | 4 | 42.2367 | 23 ⅜ | 4 | 100.8797 | 35 7¼ |
| 5 | 9.1683 | 10 8¾ | 5 | 43.2022 | 23 2⅛ | 5 | 102.3689 | 35 10⅝ |
| 6 | 9.6211 | 10 11⅞ | 6 | 44.1787 | 23 6¾ | 6 | 103.8691 | 36 1½ |
| 7 | 10.0846 | 11 3 | 7 | 45.1656 | 23 9⅞ | 7 | 105.3794 | 36 4½ |
| 8 | 10.5591 | 11 6⅛ | 8 | 46.1638 | 24 1⅛ | 8 | 106.9013 | 36 7¾ |
| 9 | 11.0446 | 11 9⅜ | 9 | 47.173 | 24 4⅜ | 9 | 108.4342 | 36 10⅞ |
| 10 | 11.5409 | 12 ½ | 10 | 48.1962 | 24 7¼ | 10 | 109.9772 | 37 2¾ |
| 11 | 12.0481 | 12 3⅝ | 11 | 49.2236 | 24 10⅜ | 11 | 111.5319 | 37 5¼ |
| 4 0 | 12.5664 | 12 6¾ | 8 0 | 50.2656 | 25 1½ | 12 0 | 113.0976 | 37 8⅜ |
| 1 | 13.0952 | 12 9⅞ | 1 | 51.3178 | 25 4⅝ | 1 | 114.6732 | 37 11½ |
| 2 | 13.6353 | 13 1 | 2 | 52.3816 | 25 7⅞ | 2 | 116.2607 | 38 2⅝ |
| 3 | 14.1862 | 13 4⅛ | 3 | 53.4562 | 25 11 | 3 | 117.859 | 38 5¾ |
| 4 | 14.7479 | 13 7¼ | 4 | 54.5412 | 26 2⅛ | 4 | 119.4674 | 38 8⅞ |
| 5 | 15.3206 | 13 10½ | 5 | 55.6377 | 26 5¼ | 5 | 121.0876 | 39 0 |
| 6 | 15.9043 | 14 1⅝ | 6 | 56.7451 | 26 8⅜ | 6 | 122.7187 | 39 3¼ |
| 7 | 16.4986 | 14 4⅝ | 7 | 57.8628 | 26 11½ | 7 | 124.3598 | 39 6⅜ |
| 8 | 17.1041 | 14 7⅞ | 8 | 58.992 | 27 2¾ | 8 | 126.0127 | 39 9½ |
| 9 | 17.7205 | 14 11 | 9 | 60.1321 | 27 5¾ | 9 | 127.6765 | 40 ⅝ |
| 10 | 18.3476 | 15 2⅛ | 10 | 61.2826 | 27 9 | 10 | 129.3504 | 40 3¾ |
| 11 | 18.9858 | 15 5¼ | 11 | 62.4445 | 28 ⅛ | 11 | 131.036 | 40 6⅞ |

## Areas and Circumferences of Circles (Continued)

| Diam., ft | in | Area, sq ft | Circum., ft | in |
|---|---|---|---|---|
| 13 | 0 | 132.7326 | 40 | 10 |
| | 1 | 134.4391 | 41 | 1⅛ |
| | 2 | 136.1574 | 41 | 4⅜ |
| | 3 | 137.8867 | 41 | 7½ |
| | 4 | 139.626 | 41 | 10⅝ |
| | 5 | 141.3771 | 42 | 1⅝ |
| | 6 | 143.1391 | 42 | 4⅞ |
| | 7 | 144.9111 | 42 | 8 |
| | 8 | 146.6949 | 42 | 11¼ |
| | 9 | 148.4896 | 43 | 2¼ |
| | 10 | 150.2943 | 43 | 5½ |
| | 11 | 152.1109 | 43 | 8⅝ |
| 14 | 0 | 153.9384 | 43 | 11¾ |
| | 1 | 155.7758 | 44 | 2⅞ |
| | 2 | 157.625 | 44 | 6 |
| | 3 | 159.4852 | 44 | 9⅛ |
| | 4 | 161.3553 | 45 | ¼ |
| | 5 | 163.2373 | 45 | 3½ |
| | 6 | 165.1303 | 45 | 6⅝ |
| | 7 | 167.0331 | 45 | 9¾ |
| | 8 | 168.9479 | 46 | ⅞ |
| | 9 | 170.8735 | 46 | 4 |
| | 10 | 172.8091 | 46 | 7⅛ |
| | 11 | 174.7565 | 46 | 11¼ |
| 15 | 0 | 176.715 | 47 | 1½ |
| | 1 | 178.6832 | 47 | 4⅝ |
| | 2 | 180.6634 | 47 | 7¾ |
| | 3 | 182.6545 | 47 | 10⅞ |
| | 4 | 184.6555 | 48 | 2½ |
| | 5 | 186.6684 | 48 | 5⅛ |
| | 6 | 188.6923 | 48 | 8¼ |
| | 7 | 190.726 | 48 | 11⅜ |
| | 8 | 192.7716 | 49 | 2⅝ |
| | 9 | 194.8282 | 49 | 5¾ |
| | 10 | 196.8946 | 49 | 8⅞ |
| | 11 | 198.973 | 50 | 0 |
| 16 | 0 | 201.0624 | 50 | 3⅛ |
| | 1 | 203.1615 | 50 | 6¼ |
| | 2 | 205.2726 | 50 | 9⅝ |
| | 3 | 207.3946 | 51 | ½ |
| | 4 | 209.5264 | 51 | 3¾ |
| | 5 | 211.6703 | 51 | 6½ |
| | 6 | 213.8251 | 51 | 10 |
| | 7 | 215.9896 | 52 | 1⅛ |
| | 8 | 218.1662 | 52 | 4¼ |
| | 9 | 220.3537 | 52 | 7⅜ |
| | 10 | 222.551 | 52 | 10½ |
| | 11 | 224.7608 | 53 | 1⅝ |
| 17 | 0 | 226.9806 | 53 | 4⅞ |
| | 1 | 229.2105 | 53 | 8 |
| | 2 | 231.4525 | 53 | 11⅛ |
| | 3 | 233.7055 | 54 | 2⅛ |
| | 4 | 235.9682 | 54 | 5⅜ |
| | 5 | 238.243 | 54 | 8½ |
| | 6 | 240.5287 | 54 | 11⅝ |
| | 7 | 242.8241 | 55 | 2⅞ |
| | 8 | 245.1316 | 55 | 6 |
| | 9 | 247.45 | 55 | 9⅛ |
| | 10 | 249.7781 | 56 | ¼ |
| | 11 | 252.1184 | 56 | 3½ |
| 18 | 0 | 254.4696 | 56 | 6½ |
| | 1 | 256.8303 | 56 | 9⅝ |
| | 2 | 259.2033 | 57 | ⅞ |
| | 3 | 261.5872 | 57 | 4 |
| | 4 | 263.9807 | 57 | 7⅛ |
| | 5 | 266.3864 | 57 | 10¼ |
| | 6 | 268.8031 | 58 | 1⅜ |
| | 7 | 271.2293 | 58 | 4½ |
| | 8 | 273.6678 | 58 | 7⅝ |
| | 9 | 276.1171 | 58 | 10¾ |
| | 10 | 278.5761 | 59 | 2 |
| | 11 | 281.0472 | 59 | 5⅛ |
| 19 | 0 | 283.5294 | 59 | 8¼ |
| | 1 | 286.021 | 59 | 11½ |
| | 2 | 288.5249 | 60 | 2½ |
| | 3 | 291.0397 | 60 | 5⅝ |
| | 4 | 293.5641 | 60 | 8¾ |
| | 5 | 296.1107 | 60 | 11⅞ |
| | 6 | 298.6483 | 61 | 3⅛ |
| | 7 | 301.2054 | 61 | 6¼ |
| | 8 | 303.7747 | 61 | 9½ |
| | 9 | 306.355 | 62 | ½ |
| | 10 | 308.9448 | 62 | 3⅝ |
| | 11 | 311.5469 | 62 | 6¾ |
| 20 | 0 | 314.16 | 62 | 9⅞ |
| | 1 | 316.7824 | 63 | 1⅛ |
| | 2 | 319.4173 | 63 | 4¼ |
| | 3 | 322.063 | 63 | 7⅜ |
| | 4 | 324.7182 | 63 | 11½ |
| | 5 | 327.3858 | 64 | 1⅝ |
| | 6 | 330.0643 | 64 | 4¾ |
| | 7 | 332.7522 | 64 | 7⅞ |
| | 8 | 335.4525 | 64 | 11 |
| | 9 | 338.1637 | 65 | 2¼ |
| | 10 | 340.8844 | 65 | 5⅜ |
| | 11 | 343.6174 | 65 | 8¼ |
| 21 | 0 | 346.3614 | 65 | 11⅝ |
| | 1 | 349.1147 | 66 | 2¾ |
| | 2 | 351.8804 | 66 | 5⅞ |
| | 3 | 354.6571 | 66 | 9 |
| | 4 | 357.4432 | 67 | ⅛ |
| | 5 | 360.2417 | 67 | 3⅜ |
| | 6 | 363.0511 | 67 | 6½ |
| | 7 | 365.8698 | 67 | 9⅝ |
| | 8 | 368.7011 | 68 | ¾ |
| | 9 | 371.5432 | 68 | 3⅞ |
| | 10 | 374.3947 | 68 | 7 |
| | 11 | 377.2587 | 68 | 10¼ |
| 22 | 0 | 380.1336 | 69 | 1⅜ |
| | 1 | 383.0177 | 69 | 4½ |
| | 2 | 385.9144 | 69 | 7⅝ |
| | 3 | 388.822 | 69 | 10¾ |
| | 4 | 391.7389 | 70 | 1⅞ |
| | 5 | 394.6683 | 70 | 5 |
| | 6 | 397.6087 | 70 | 8¼ |
| | 7 | 400.5583 | 70 | 11⅛ |
| | 8 | 403.5204 | 71 | 2½ |
| | 9 | 406.4935 | 71 | 5⅝ |
| | 10 | 409.4759 | 71 | 8¾ |
| | 11 | 412.4707 | 71 | 11⅞ |
| 23 | 0 | 415.4766 | 72 | 3 |
| | 1 | 418.4915 | 72 | 6⅛ |
| | 2 | 421.5192 | 72 | 9⅜ |
| | 3 | 424.5577 | 73 | ½ |
| | 4 | 427.6055 | 73 | 3⅝ |
| | 5 | 430.6658 | 73 | 6¾ |
| | 6 | 433.7371 | 73 | 9⅞ |
| | 7 | 436.8175 | 74 | 1 |
| | 8 | 439.9106 | 74 | 4⅛ |
| | 9 | 443.0146 | 74 | 7¼ |
| | 10 | 446.1278 | 74 | 10⅝ |
| | 11 | 449.2536 | 75 | 1⅝ |
| 24 | 0 | 452.3904 | 75 | 4¾ |
| | 1 | 455.5362 | 75 | 7⅞ |
| | 2 | 458.6948 | 75 | 11 |
| | 3 | 461.8642 | 76 | 2⅛ |
| | 4 | 465.0428 | 76 | 5¼ |
| | 5 | 468.2341 | 76 | 8½ |
| | 6 | 471.4363 | 76 | 11⅝ |
| | 7 | 474.6476 | 77 | 2¾ |
| | 8 | 477.8716 | 77 | 5⅞ |
| | 9 | 481.1065 | 77 | 9 |
| | 10 | 484.3506 | 78 | ⅛ |
| | 11 | 487.6073 | 78 | 3¼ |
| 25 | 0 | 490.875 | 78 | 6½ |
| | 1 | 494.1516 | 78 | 9½ |
| | 2 | 497.4411 | 79 | ¾ |
| | 3 | 500.7415 | 79 | 3⅞ |
| | 4 | 504.051 | 79 | 7⅛ |
| | 5 | 507.3732 | 79 | 11⅛ |
| | 6 | 510.7063 | 80 | 1¼ |
| | 7 | 514.0484 | 80 | 4⅜ |
| | 8 | 517.4034 | 80 | 7⅝ |
| | 9 | 520.7692 | 80 | 10¾ |
| | 10 | 524.1441 | 81 | 1⅞ |
| | 11 | 527.5318 | 81 | 5 |
| 26 | 0 | 530.9304 | 81 | 8⅛ |
| | 1 | 534.3379 | 81 | 11¼ |
| | 2 | 537.7583 | 82 | 2⅜ |
| | 3 | 541.1896 | 82 | 5¼ |
| | 4 | 544.6299 | 82 | 8⅝ |
| | 5 | 548.083 | 82 | 11⅞ |
| | 6 | 551.5471 | 83 | 3 |
| | 7 | 555.0201 | 83 | 6⅛ |
| | 8 | 558.5059 | 83 | 9¼ |
| | 9 | 562.0027 | 84 | ⅜ |
| | 10 | 565.5084 | 84 | 3½ |
| | 11 | 569.027 | 84 | 6⅝ |
| 27 | 0 | 572.5566 | 84 | 9⅞ |
| | 1 | 576.0949 | 85 | 1 |
| | 2 | 579.6463 | 85 | 4¼ |
| | 3 | 583.2085 | 85 | 8⅛ |
| | 4 | 586.7796 | 85 | 11⅜ |
| | 5 | 590.3637 | 86 | 1½ |
| | 6 | 593.9587 | 86 | 4⅝ |
| | 7 | 597.5625 | 86 | 7⅞ |
| | 8 | 601.1793 | 86 | 11 |
| | 9 | 604.807 | 87 | 2⅛ |
| | 10 | 608.4436 | 87 | 5¼ |
| | 11 | 612.0931 | 87 | 8¾ |

## Table of Areas and Circumferences of Circles

### Areas and Circumferences of Circles (Continued)

| Diam., ft | in | Area, sq ft | Circum., ft | in |
|---|---|---|---|---|
| 28 | 0 | 615.7536 | 87 | 11½ |
| | 1 | 619.4228 | 88 | 2⅝ |
| | 2 | 623.105 | 88 | 5¾ |
| | 3 | 626.7982 | 88 | 9 |
| | 4 | 630.5002 | 89 | ⅛ |
| | 5 | 634.2152 | 89 | 3¼ |
| | 6 | 637.9411 | 89 | 6⅜ |
| | 7 | 641.6758 | 89 | 9½ |
| | 8 | 645.4235 | 90 | ⅝ |
| | 9 | 649.1821 | 90 | 3¾ |
| | 10 | 652.9495 | 90 | 6⅞ |
| | 11 | 656.73 | 90 | 11⅛ |
| 29 | 0 | 660.5214 | 91 | 1¼ |
| | 1 | 664.3214 | 91 | 4⅜ |
| | 2 | 668.1346 | 91 | 7½ |
| | 3 | 671.9587 | 91 | 10⅝ |
| | 4 | 675.7915 | 92 | 1¾ |
| | 5 | 679.6375 | 92 | 4⅞ |
| | 6 | 683.4943 | 92 | 8⅛ |
| | 7 | 687.3598 | 92 | 11⅓ |
| | 8 | 691.2385 | 93 | 2⅜ |
| | 9 | 695.1028 | 93 | 5½ |
| | 10 | 699.0263 | 93 | 8⅝ |
| | 11 | 702.9377 | 93 | 11⅞ |
| 30 | 0 | 706.86 | 94 | 2⅞ |
| | 1 | 710.791 | 94 | 6 |
| | 2 | 714.735 | 94 | 9¼ |
| | 3 | 718.69 | 95 | ⅜ |
| | 4 | 722.654 | 95 | 3½ |
| | 5 | 726.631 | 95 | 6⅝ |
| | 6 | 730.618 | 95 | 9¾ |
| | 7 | 734.615 | 96 | ⅞ |
| | 8 | 738.624 | 96 | 4 |
| | 9 | 742.645 | 96 | 7¼ |
| | 10 | 746.674 | 96 | 10⅜ |
| | 11 | 750.716 | 97 | 1½ |
| 31 | 0 | 754.769 | 97 | 4⅝ |
| | 1 | 758.831 | 97 | 7¾ |
| | 2 | 762.906 | 97 | 10⅞ |
| | 3 | 766.992 | 98 | 2 |
| | 4 | 771.086 | 98 | 5⅛ |
| | 5 | 775.191 | 98 | 8⅜ |
| | 6 | 779.313 | 98 | 11½ |
| | 7 | 783.440 | 99 | 2⅝ |
| | 8 | 787.581 | 99 | 5¾ |
| | 9 | 791.732 | 99 | 8⅞ |
| | 10 | 795.892 | 100 | 0 |
| | 11 | 800 065 | 100 | 3⅛ |
| 32 | 0 | 804.25 | 100 | 6⅜ |
| | 1 | 808.442 | 100 | 9½ |
| | 2 | 812.648 | 101 | ⅝ |
| | 3 | 816.865 | 101 | 3¾ |
| | 4 | 821.090 | 101 | 6⅞ |
| | 5 | 825.329 | 101 | 10 |
| | 6 | 829.579 | 102 | 1⅛ |
| | 7 | 833 837 | 102 | 4⅜ |
| | 8 | 838.108 | 102 | 7½ |
| | 9 | 842.391 | 102 | 10⅝ |
| | 10 | 846.681 | 103 | 1¾ |
| | 11 | 850 985 | 103 | 4⅞ |
| 33 | 0 | 855.301 | 103 | 8 |
| | 1 | 859.624 | 103 | 11⅛ |
| | 2 | 863.961 | 104 | 2¼ |
| | 3 | 868.309 | 104 | 5⅜ |
| | 4 | 872.665 | 104 | 8⅝ |
| | 5 | 877.035 | 104 | 11¾ |
| | 6 | 881.415 | 105 | 2⅞ |
| | 7 | 885.804 | 105 | 6 |
| | 8 | 890.206 | 105 | 9⅛ |
| | 9 | 894.619 | 106 | ¼ |
| | 10 | 899.041 | 106 | 3⅜ |
| | 11 | 903.476 | 106 | 6⅝ |
| 34 | 0 | 907.922 | 106 | 9¾ |
| | 1 | 912.377 | 107 | ⅞ |
| | 2 | 916.844 | 107 | 4 |
| | 3 | 921.323 | 107 | 7⅛ |
| | 4 | 925.810 | 107 | 10¼ |
| | 5 | 930.311 | 108 | 1⅜ |
| | 6 | 934.822 | 108 | 4⅝ |
| | 7 | 939.342 | 108 | 7¾ |
| | 8 | 943.875 | 108 | 10⅞ |
| | 9 | 948.419 | 109 | 2 |
| | 10 | 952.972 | 109 | 5⅛ |
| | 11 | 957.538 | 109 | 8¼ |
| 35 | 0 | 962.115 | 109 | 11⅜ |
| | 1 | 966.770 | 110 | 2⅝ |
| | 2 | 971.299 | 110 | 5¾ |
| | 3 | 975.908 | 110 | 8⅞ |
| | 4 | 980.526 | 111 | 0 |
| | 5 | 985.158 | 111 | 3⅛ |
| | 6 | 989.803 | 111 | 6¼ |
| | 7 | 994.451 | 111 | 9⅜ |
| | 8 | 999.115 | 112 | ½ |
| | 9 | 1003.79 | 112 | 3¾ |
| | 10 | 1008.473 | 112 | 6⅞ |
| | 11 | 1013.170 | 112 | 10 |
| 36 | 0 | 1017.878 | 113 | 1⅛ |
| | 1 | 1022.594 | 113 | 4¼ |
| | 2 | 1027.324 | 113 | 7⅜ |
| | 3 | 1032.064 | 113 | 10⅝ |
| | 4 | 1036.813 | 114 | 1¾ |
| | 5 | 1041.576 | 114 | 4⅞ |
| | 6 | 1046.349 | 114 | 8 |
| | 7 | 1051.130 | 114 | 11⅛ |
| | 8 | 1055.926 | 115 | 2¼ |
| | 9 | 1060.731 | 115 | 5⅜ |
| | 10 | 1065.546 | 115 | 9¼ |
| | 11 | 1070.374 | 115 | 11⅝ |
| 37 | 0 | 1075.2126 | 116 | 2⅞ |
| | 1 | 1080.059 | 116 | 6 |
| | 2 | 1084.920 | 116 | 9⅛ |
| | 3 | 1089 791 | 117 | ¼ |
| | 4 | 1094.671 | 117 | 3½ |
| | 5 | 1099.564 | 117 | 6½ |
| | 6 | 1104 469 | 117 | 9⅝ |
| | 7 | 1109.381 | 118 | ¾ |
| | 8 | 1114 307 | 118 | 4 |
| | 9 | 1119.244 | 118 | 7⅛ |
| | 10 | 1124.189 | 118 | 10¼ |
| | 11 | 1129.148 | 119 | 1⅜ |
| 38 | 0 | 1134.118 | 119 | 4½ |
| | 1 | 1139.095 | 119 | 7⅝ |
| | 2 | 1144.087 | 119 | 10¾ |
| | 3 | 1149.089 | 120 | 2 |
| | 4 | 1154.110 | 120 | 5⅛ |
| | 5 | 1159.124 | 120 | 8⅜ |
| | 6 | 1164.159 | 120 | 11⅜ |
| | 7 | 1169.202 | 121 | 2½ |
| | 8 | 1174.259 | 121 | 5⅝ |
| | 9 | 1179.327 | 121 | 8¾ |
| | 10 | 1184.403 | 121 | 11⅞ |
| | 11 | 1189.493 | 122 | 3⅛ |
| 39 | 0 | 1194.593 | 122 | 6¼ |
| | 1 | 1199.719 | 122 | 9½ |
| | 2 | 1204.824 | 123 | ⅛ |
| | 3 | 1209.958 | 123 | 3⅝ |
| | 4 | 1215.099 | 123 | 6¾ |
| | 5 | 1220.254 | 123 | 9⅞ |
| | 6 | 1225.420 | 124 | 1⅛ |
| | 7 | 1230.594 | 124 | 4¼ |
| | 8 | 1235.782 | 124 | 7⅜ |
| | 9 | 1240.981 | 124 | 10½ |
| | 10 | 1246.188 | 125 | 1⅝ |
| | 11 | 1251.408 | 125 | 4¾ |
| 40 | 0 | 1256.64 | 125 | 7⅞ |
| | 1 | 1261.879 | 125 | 11 |
| | 2 | 1267.133 | 126 | 2¼ |
| | 3 | 1272.397 | 126 | 5⅜ |
| | 4 | 1277.669 | 126 | 8½ |
| | 5 | 1282.955 | 126 | 11⅝ |
| | 6 | 1288.252 | 127 | 2¾ |
| | 7 | 1293.557 | 127 | 5⅞ |
| | 8 | 1298.876 | 127 | 9 |
| | 9 | 1304.206 | 128 | ¼ |
| | 10 | 1309.543 | 128 | 3⅜ |
| | 11 | 1314.895 | 128 | 6½ |
| 41 | 0 | 1320.257 | 128 | 9⅝ |
| | 1 | 1325.628 | 129 | ¾ |
| | 2 | 1331.012 | 129 | 3⅞ |
| | 3 | 1336.407 | 129 | 7 |
| | 4 | 1341.810 | 129 | 10⅛ |
| | 5 | 1347.227 | 130 | 1⅜ |
| | 6 | 1352.655 | 130 | 4½ |
| | 7 | 1358.091 | 130 | 7⅝ |
| | 8 | 1363.541 | 130 | 10¾ |
| | 9 | 1369.001 | 131 | 1⅞ |
| | 10 | 1374.47 | 131 | 5 |
| | 11 | 1379.952 | 131 | 8⅛ |
| 42 | 0 | 1385.446 | 131 | 11⅜ |
| | 1 | 1390.247 | 132 | 2½ |
| | 2 | 1396.462 | 132 | 5⅝ |
| | 3 | 1401.988 | 132 | 8¾ |
| | 4 | 1407 522 | 132 | 11⅞ |
| | 5 | 1413.07 | 133 | 3 |
| | 6 | 1418.629 | 133 | 6⅛ |
| | 7 | 1424.195 | 133 | 9¼ |
| | 8 | 1429.776 | 134 | ½ |
| | 9 | 1435.367 | 134 | 3⅝ |
| | 10 | 1440.967 | 134 | 6¾ |
| | 11 | 1446.580 | 134 | 9⅞ |

**Areas and Circumferences of Circles (Continued)**

| Diam., ft in | Area, sq ft | Circum., ft in | Diam., ft in | Area, sq ft | Circum., ft in | Diam., ft in | Area, sq ft | Circum., ft in |
|---|---|---|---|---|---|---|---|---|
| 43 0 | 1452.205 | 135 1 | 46 0 | 1661.906 | 144 6⅛ | 49 0 | 1885.745 | 153 11¼ |
| 1 | 1457.836 | 135 4⅛ | 1 | 1667.931 | 144 9¼ | 1 | 1892.172 | 154 2⅜ |
| 2 | 1463.483 | 135 7¼ | 2 | 1673.97 | 145 ⅜ | 2 | 1898.504 | 154 5½ |
| 3 | 1469.14 | 135 10½ | 3 | 1680.02 | 145 3½ | 3 | 1905.037 | 154 8⅝ |
| 4 | 1474.804 | 136 1⅝ | 4 | 1686.077 | 145 6⅝ | 4 | 1911.497 | 154 11⅞ |
| 5 | 1480.483 | 136 4¾ | 5 | 1692.148 | 145 9⅞ | 5 | 1917.961 | 155 2⅞ |
| 6 | 1486.173 | 136 7⅞ | 6 | 1698.231 | 146 1⅛ | 6 | 1924.426 | 155 6 |
| 7 | 1491.870 | 136 11 | 7 | 1704.321 | 146 4⅛ | 7 | 1930.919 | 155 9¼ |
| 8 | 1497.582 | 137 2⅛ | 8 | 1710.425 | 146 7¼ | 8 | 1937.316 | 156 ⅛ |
| 9 | 1503.305 | 137 5¼ | 9 | 1716.541 | 146 10⅜ | 9 | 1943.914 | 156 3½ |
| 10 | 1509.035 | 137 8⅜ | 10 | 1722.663 | 147 1½ | 10 | 1950.439 | 156 6⅝ |
| 11 | 1514.779 | 137 11⅝ | 11 | 1728.801 | 147 4⅝ | 11 | 1956.969 | 156 9¾ |
| 44 0 | 1520.534 | 138 2¾ | 47 0 | 1734.947 | 147 7¾ | 50 0 | 1963.5 | 157 ⅞ |
| 1 | 1526.297 | 138 5⅞ | 1 | 1741.104 | 147 11 | ..... | ..... | ..... |
| 2 | 1532.074 | 138 9 | 2 | 1747.274 | 148 2⅛ | ..... | ..... | ..... |
| 3 | 1537.862 | 139 ⅛ | 3 | 1753.455 | 148 5¼ | ..... | ..... | ..... |
| 4 | 1543.658 | 139 3¼ | 4 | 1759.643 | 148 8⅜ | ..... | ..... | ..... |
| 5 | 1549.478 | 139 6⅜ | 5 | 1765.845 | 148 11½ | ..... | ..... | ..... |
| 6 | 1555.288 | 139 9⅝ | 6 | 1772.059 | 149 2⅝ | ..... | ..... | ..... |
| 7 | 1561.116 | 140 ¾ | 7 | 1778.28 | 149 5⅞ | ..... | ..... | ..... |
| 8 | 1566.959 | 140 3⅞ | 8 | 1784.515 | 149 8⅞ | ..... | ..... | ..... |
| 9 | 1572.812 | 140 7½ | 9 | 1790.761 | 150 ⅛ | ..... | ..... | ..... |
| 10 | 1578.673 | 140 10⅛ | 10 | 1797.015 | 150 3¼ | ..... | ..... | ..... |
| 11 | 1584.549 | 141 1¼ | 11 | 1803.283 | 150 6⅜ | ..... | ..... | ..... |
| 45 0 | 1590.435 | 141 4⅜ | 48 0 | 1809.562 | 150 9½ | ..... | ..... | ..... |
| 1 | 1596.329 | 141 7½ | 1 | 1815.848 | 151 ⅝ | ..... | ..... | ..... |
| 2 | 1602.237 | 141 10⅝ | 2 | 1822.149 | 151 3¾ | ..... | ..... | ..... |
| 3 | 1608.155 | 142 1⅞ | 3 | 1828.460 | 151 6⅞ | ..... | ..... | ..... |
| 4 | 1614.082 | 142 5 | 4 | 1834.779 | 151 10⅛ | ..... | ..... | ..... |
| 5 | 1620.023 | 142 8⅛ | 5 | 1841.173 | 152 1¼ | ..... | ..... | ..... |
| 6 | 1625.974 | 142 11¼ | 6 | 1847.457 | 152 4⅜ | ..... | ..... | ..... |
| 7 | 1631.933 | 143 2⅜ | 7 | 1853.809 | 152 7½ | ..... | ..... | ..... |
| 8 | 1637.907 | 143 5½ | 8 | 1860.175 | 152 10⅝ | ..... | ..... | ..... |
| 9 | 1643.891 | 143 8¾ | 9 | 1866.552 | 153 1¾ | ..... | ..... | ..... |
| 10 | 1649.883 | 143 11⅞ | 10 | 1872.937 | 153 4⅞ | ..... | ..... | ..... |
| 11 | 1655.889 | 144 3 | 11 | 1879.335 | 153 8⅛ | ..... | ..... | ..... |

## Tables of Squares, Cubes, Square Roots, Cube Roots and Reciprocals

From 1 to 1054

The tables on the following pages will be found of great convenience in finding the square, cube, square root, cube root and reciprocal of any number from 1 to 1054. The reciprocal of a number is the quotient obtained by dividing 1 by the number. Thus, the reciprocal of 8 is $1 \div 8 = 0.125$.

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 1.0000000 | 1.0000000 | 1.000000000 |
| 2 | 4 | 8 | 1.4142136 | 1.2599210 | .500000000 |
| 3 | 9 | 27 | 1.7320508 | 1.4422496 | .333333333 |
| 4 | 16 | 64 | 2.0000000 | 1.5874011 | .250000000 |
| 5 | 25 | 125 | 2.2360680 | 1.7099759 | .200000000 |
| 6 | 36 | 216 | 2.4494897 | 1.8171206 | .166666667 |
| 7 | 49 | 343 | 2.6457513 | 1.9129312 | .142857143 |
| 8 | 64 | 512 | 2.8284271 | 2.0000000 | .125000000 |
| 9 | 81 | 729 | 3.0000000 | 2.0800837 | .111111111 |
| 10 | 100 | 1000 | 3.1622777 | 2.1544347 | .100000000 |
| 11 | 121 | 1331 | 3.3166248 | 2.2239801 | .090909091 |
| 12 | 144 | 1728 | 3.4641016 | 2.2894286 | .083333333 |
| 13 | 169 | 2197 | 3.6055513 | 2.3513347 | .076923077 |
| 14 | 196 | 2744 | 3.7416574 | 2.4101422 | .071428571 |
| 15 | 225 | 3375 | 3.8729833 | 2.4662121 | .066666667 |
| 16 | 256 | 4096 | 4.0000000 | 2.5198421 | .062500000 |
| 17 | 289 | 4913 | 4.1231056 | 2.5712816 | .058823529 |
| 18 | 324 | 5832 | 4.2426407 | 2.6207414 | .055555556 |
| 19 | 361 | 6859 | 4.3588989 | 2.6684016 | .052631579 |
| 20 | 400 | 8000 | 4.4721360 | 2.7144177 | .050000000 |
| 21 | 441 | 9261 | 4.5825757 | 2.7589243 | .047619048 |
| 22 | 484 | 10648 | 4.6904158 | 2.8020393 | .045454545 |
| 23 | 529 | 12167 | 4.7958315 | 2.8438670 | .043478261 |
| 24 | 576 | 13824 | 4.8989795 | 2.8844991 | .041666667 |
| 25 | 625 | 15625 | 5.0000000 | 2.9240177 | .040000000 |
| 26 | 676 | 17576 | 5.0990195 | 2.9624960 | .038461538 |
| 27 | 729 | 19683 | 5.1961524 | 3.0000000 | .037037037 |
| 28 | 784 | 21952 | 5.2915026 | 3.0365889 | .035714286 |
| 29 | 841 | 24389 | 5.3851648 | 3.0723168 | .034482759 |
| 30 | 900 | 27000 | 5.4772256 | 3.1072325 | .033333333 |
| 31 | 961 | 29791 | 5.5677644 | 3.1413806 | .032258065 |
| 32 | 1024 | 32768 | 5.6568542 | 3.1748021 | .031250000 |
| 33 | 1089 | 35937 | 5.7445626 | 3.2075343 | .030303030 |
| 34 | 1156 | 39304 | 5.8309519 | 3.2396118 | .029411765 |
| 35 | 1225 | 42875 | 5.9160798 | 3.2710663 | .028571429 |
| 36 | 1296 | 46656 | 6.0000000 | 3.3019272 | .027777778 |
| 37 | 1369 | 50653 | 6.0827625 | 3.3322218 | .027027027 |
| 38 | 1444 | 54872 | 6.1644140 | 3.3619754 | .026315789 |
| 39 | 1521 | 59319 | 6.2449980 | 3.3912114 | .025641026 |
| 40 | 1600 | 64000 | 6.3245553 | 3.4199519 | .025000000 |
| 41 | 1681 | 68921 | 6.4031242 | 3.4482172 | .024390244 |
| 42 | 1764 | 74088 | 6.4807407 | 3.4760266 | .023809524 |
| 43 | 1849 | 79507 | 6.5574385 | 3.5033981 | .023255814 |
| 44 | 1936 | 85184 | 6.6332496 | 3.5303483 | .022727273 |
| 45 | 2025 | 91125 | 6.7082039 | 3.5568933 | .022222222 |
| 46 | 2116 | 97336 | 6.7823300 | 3.5830479 | .021739130 |
| 47 | 2209 | 103823 | 6.8556546 | 3.6088261 | .021276600 |
| 48 | 2304 | 110592 | 6.9282032 | 3.6342411 | .020833333 |
| 49 | 2401 | 117649 | 7.0000000 | 3.6593057 | .020408163 |
| 50 | 2500 | 125000 | 7.0710678 | 3.6840314 | .020000000 |
| 51 | 2601 | 132651 | 7.1414284 | 3.7084298 | .019607843 |
| 52 | 2704 | 140608 | 7.2111026 | 3.7325111 | .019230769 |
| 53 | 2809 | 148877 | 7.2801099 | 3.7562858 | .018867925 |
| 54 | 2916 | 157464 | 7.3484692 | 3.7797631 | .018518519 |
| 55 | 3025 | 166375 | 7.4161985 | 3.8029525 | .018181818 |
| 56 | 3136 | 175616 | 7.4833148 | 3.8258624 | .017857143 |
| 57 | 3249 | 185193 | 7.5498344 | 3.8485011 | .017543860 |
| 58 | 3364 | 195112 | 7.6157731 | 3.8708766 | .017241379 |
| 59 | 3481 | 205379 | 7.6811457 | 3.8929965 | .016949153 |
| 60 | 3600 | 216000 | 7.7459667 | 3.9148676 | .016666667 |
| 61 | 3721 | 226981 | 7.8102497 | 3.9364972 | .016393443 |
| 62 | 3844 | 238328 | 7.8740079 | 3.9578915 | .016129032 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 63 | 3969 | 250047 | 7.9372539 | 3.9790571 | .015873016 |
| 64 | 4096 | 262144 | 8.0000000 | 4.0000000 | .015625000 |
| 65 | 4225 | 274625 | 8.0622577 | 4.0207256 | .015384615 |
| 66 | 4356 | 287496 | 8.1240384 | 4.0412401 | .015151515 |
| 67 | 4489 | 300763 | 8.1853528 | 4.0615480 | .014925373 |
| 68 | 4624 | 314432 | 8.2462113 | 4.0816551 | .014705882 |
| 69 | 4761 | 328509 | 8.3066239 | 4.1015661 | .014492754 |
| 70 | 4900 | 343000 | 8.3666003 | 4.1212853 | .014285714 |
| 71 | 5041 | 357911 | 8.4261498 | 4.1408178 | .014084507 |
| 72 | 5184 | 373248 | 8.4852814 | 4.1601676 | .013888889 |
| 73 | 5329 | 389017 | 8.5440037 | 4.1793390 | .013698630 |
| 74 | 5476 | 405224 | 8.6023253 | 4.1983364 | .013513514 |
| 75 | 5625 | 421875 | 8.6602540 | 4.2171633 | .013333333 |
| 76 | 5776 | 438976 | 8.7177979 | 4.2358236 | .013157895 |
| 77 | 5929 | 456533 | 8.7749644 | 4.2543210 | .012987013 |
| 78 | 6084 | 474552 | 8.8317609 | 4.2726586 | .012820513 |
| 79 | 6241 | 493039 | 8.8881944 | 4.2908404 | .012658228 |
| 80 | 6400 | 512000 | 8.9442719 | 4.3088695 | .012500000 |
| 81 | 6561 | 531441 | 9.0000000 | 4.3267487 | .012345679 |
| 82 | 6724 | 551368 | 9.0553851 | 4.3444815 | .012195122 |
| 83 | 6889 | 571787 | 9.1104336 | 4.3620707 | .012048193 |
| 84 | 7056 | 592704 | 9.1651514 | 4.3795191 | .011904762 |
| 85 | 7225 | 614125 | 9.2195445 | 4.3968296 | .011764706 |
| 86 | 7396 | 636056 | 9.2736185 | 4.4140049 | .011627907 |
| 87 | 7569 | 658503 | 9.3273791 | 4.4310476 | .011494253 |
| 88 | 7744 | 681472 | 9.3808315 | 4.4479602 | .011363636 |
| 89 | 7921 | 704969 | 9.4339811 | 4.4647451 | .011235955 |
| 90 | 8100 | 729000 | 9.4868330 | 4.4814047 | .011111111 |
| 91 | 8281 | 753571 | 9.5393920 | 4.4979414 | .010989011 |
| 92 | 8464 | 778688 | 9.5916630 | 4.5143574 | .010869565 |
| 93 | 8649 | 804357 | 9.6436508 | 4.5306549 | .010752688 |
| 94 | 8836 | 830584 | 9.6953597 | 4.5468359 | .010638298 |
| 95 | 9025 | 857375 | 9.7467943 | 4.5629026 | .010526316 |
| 96 | 9216 | 884736 | 9.7979590 | 4.5788570 | .010416667 |
| 97 | 9409 | 912673 | 9.8488578 | 4.5947009 | .010309278 |
| 98 | 9604 | 941192 | 9.8994949 | 4.6104363 | .010204082 |
| 99 | 9801 | 970299 | 9.9498744 | 4.6260650 | .010101010 |
| 100 | 10000 | 1000000 | 10.0000000 | 4.6415888 | .010000000 |
| 101 | 10201 | 1030301 | 10.0498756 | 4.6570095 | .009900990 |
| 102 | 10404 | 1061208 | 10.0995049 | 4.6723287 | .009803922 |
| 103 | 10609 | 1092727 | 10.1488916 | 4.6875482 | .009708738 |
| 104 | 10816 | 1124864 | 10.1980390 | 4.7026694 | .009615385 |
| 105 | 11025 | 1157625 | 10.2469508 | 4.7176940 | .009523810 |
| 106 | 11236 | 1191016 | 10.2956301 | 4.7326235 | .009433962 |
| 107 | 11449 | 1225043 | 10.3440804 | 4.7474594 | .009345794 |
| 108 | 11664 | 1259712 | 10.3923048 | 4.7622032 | .009259259 |
| 109 | 11881 | 1295029 | 10.4403065 | 4.7768562 | .009174312 |
| 110 | 12100 | 1331000 | 10.4880885 | 4.7914199 | .009090909 |
| 111 | 12321 | 1367631 | 10.5356538 | 4.8058955 | .009009009 |
| 112 | 12544 | 1404928 | 10.5830052 | 4.8202845 | .008928571 |
| 113 | 12769 | 1442897 | 10.6301458 | 4.8345881 | .008849558 |
| 114 | 12996 | 1481544 | 10.6770783 | 4.8488076 | .008771930 |
| 115 | 13225 | 1520875 | 10.7238053 | 4.8629442 | .008695652 |
| 116 | 13456 | 1560896 | 10.7703296 | 4.8769990 | .008620690 |
| 117 | 13689 | 1601613 | 10.8166538 | 4.8909732 | .008547009 |
| 118 | 13924 | 1643032 | 10.8627805 | 4.9048681 | .008474576 |
| 119 | 14161 | 1685159 | 10.9087121 | 4.9186847 | .008403361 |
| 120 | 14400 | 1728000 | 10.9544512 | 4.9324242 | .008333333 |
| 121 | 14641 | 1771561 | 11.0000000 | 4.9460874 | .008264463 |
| 122 | 14884 | 1815848 | 11.0453610 | 4.9596757 | .008196721 |
| 123 | 15129 | 1860867 | 11.0905365 | 4.9731898 | .008130081 |
| 124 | 15376 | 1906624 | 11.1355287 | 4.9866310 | .008064516 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 125 | 15625 | 1953125 | 11.1803399 | 5.0000000 | .008000000 |
| 126 | 15876 | 2000376 | 11.2249722 | 5.0132979 | .007936508 |
| 127 | 16129 | 2048383 | 11.2694277 | 5.0265257 | .007874016 |
| 128 | 16384 | 2097152 | 11.3137085 | 5.0396842 | .007812500 |
| 129 | 16641 | 2146689 | 11.3578167 | 5.0527743 | .007751938 |
| 130 | 16900 | 2197000 | 11.4017543 | 5.0657970 | .007692308 |
| 131 | 17161 | 2248091 | 11.4455231 | 5.0787531 | .007633588 |
| 132 | 17424 | 2299968 | 11.4891253 | 5.0916434 | .007575758 |
| 133 | 17689 | 2352637 | 11.5325626 | 5.1044687 | .007518797 |
| 134 | 17956 | 2406104 | 11.5758369 | 5.1172299 | .007462687 |
| 135 | 18225 | 2460375 | 11.6189500 | 5.1299278 | .007407407 |
| 136 | 18496 | 2515456 | 11.6619038 | 5.1425632 | .007352941 |
| 137 | 18769 | 2571353 | 11.7046999 | 5.1551367 | .007299270 |
| 138 | 19044 | 2628072 | 11.7473401 | 5.1676493 | .007246377 |
| 139 | 19321 | 2685619 | 11.7898261 | 5.1801015 | .007194245 |
| 140 | 19600 | 2744000 | 11.8321596 | 5.1924941 | .007142857 |
| 141 | 19881 | 2803221 | 11.8743421 | 5.2048279 | .007092199 |
| 142 | 20164 | 2863288 | 11.9163753 | 5.2171034 | .007042254 |
| 143 | 20449 | 2924207 | 11.9582607 | 5.2293215 | .006993007 |
| 144 | 20736 | 2985984 | 12.0000000 | 5.2414828 | .006944444 |
| 145 | 21025 | 3048625 | 12.0415946 | 5.2535879 | .006896552 |
| 146 | 21316 | 3112136 | 12.0830460 | 5.2656374 | .006849315 |
| 147 | 21609 | 3176523 | 12.1243557 | 5.2776321 | .006802721 |
| 148 | 21904 | 3241792 | 12.1655251 | 5.2895725 | .006756757 |
| 149 | 22201 | 3307949 | 12.2065556 | 5.3014592 | .006711409 |
| 150 | 22500 | 3375000 | 12.2474487 | 5.3132928 | .006666667 |
| 151 | 22801 | 3442951 | 12.2882057 | 5.3250740 | .006622517 |
| 152 | 23104 | 3511808 | 12.3288280 | 5.3368033 | .006578947 |
| 153 | 23409 | 3581577 | 12.3693169 | 5.3484812 | .006535948 |
| 154 | 23716 | 3652264 | 12.4096736 | 5.3601084 | .006493506 |
| 155 | 24025 | 3723875 | 12.4498996 | 5.3716854 | .006451613 |
| 156 | 24336 | 3796416 | 12.4899960 | 5.3832126 | .006410256 |
| 157 | 24649 | 3869893 | 12.5299641 | 5.3946907 | .006369427 |
| 158 | 24964 | 3944312 | 12.5698051 | 5.4061202 | .006329114 |
| 159 | 25281 | 4019679 | 12.6095202 | 5.4175015 | .006289308 |
| 160 | 25600 | 4096000 | 12.6491106 | 5.4288352 | .006250000 |
| 161 | 25921 | 4173281 | 12.6385775 | 5.4401218 | .006211180 |
| 162 | 26244 | 4251528 | 12.7279221 | 5.4513618 | .006172840 |
| 163 | 26569 | 4330747 | 12.7671453 | 5.4625556 | .006134969 |
| 164 | 26896 | 4410944 | 12.8062485 | 5.4737037 | .006097561 |
| 165 | 27225 | 4492125 | 12.8452326 | 5.4848066 | .006060606 |
| 166 | 27556 | 4574296 | 12.8840987 | 5.4958647 | .006024096 |
| 167 | 27889 | 4657463 | 12.9228480 | 5.5068784 | .005988024 |
| 168 | 28224 | 4741632 | 12.9614814 | 5.5178484 | .005952381 |
| 169 | 28561 | 4826809 | 13.0000000 | 5.5287748 | .005917160 |
| 170 | 28900 | 4913000 | 13.0384048 | 5.5396583 | .005882353 |
| 171 | 29241 | 5000211 | 13.0766968 | 5.5504991 | .005847953 |
| 172 | 29584 | 5088448 | 13.1148770 | 5.5612978 | .005813953 |
| 173 | 29929 | 5177717 | 13.1529464 | 5.5720546 | .005780347 |
| 174 | 30276 | 5268024 | 13.1909060 | 5.5827702 | .005747126 |
| 175 | 30625 | 5359375 | 13.2287566 | 5.5934447 | .005714286 |
| 176 | 30976 | 5451776 | 13.2664992 | 5.6040787 | .005681818 |
| 177 | 31329 | 5545233 | 13.3041347 | 5.6146724 | .005649718 |
| 178 | 31684 | 5639752 | 13.3416641 | 5.6252263 | .005617978 |
| 179 | 32041 | 5735339 | 13.3790882 | 5.6357408 | .005586592 |
| 180 | 32400 | 5832000 | 13.4164079 | 5.6462162 | .005555556 |
| 181 | 32761 | 5929741 | 13.4536240 | 5.6566528 | .005524862 |
| 182 | 33124 | 6028568 | 13.4907376 | 5.6670511 | .005494505 |
| 183 | 33489 | 6128487 | 13.5277493 | 5.6774114 | .005464481 |
| 184 | 33856 | 6229504 | 13.5646600 | 5.6877340 | .005434783 |
| 185 | 34225 | 6331625 | 13.6014705 | 5.6980192 | .005405405 |
| 186 | 34596 | 6434856 | 13.6381817 | 5.7082675 | .005376344 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 187 | 34969 | 6539203 | 13.6747943 | 5.7184791 | .005347594 |
| 188 | 35344 | 6644672 | 13.7113092 | 5.7286543 | .005319149 |
| 189 | 35721 | 6751269 | 13.7477271 | 5.7387936 | .005291005 |
| 190 | 36100 | 6859000 | 13.7840488 | 5.7488971 | .005263158 |
| 191 | 36481 | 6967871 | 13.8202750 | 5.7589652 | .005235602 |
| 192 | 36864 | 7077888 | 13.8564065 | 5.7689982 | .005208333 |
| 193 | 37249 | 7189057 | 13.8924440 | 5.7789966 | .005181347 |
| 194 | 37636 | 7301384 | 13.9283883 | 5.7889604 | .005154639 |
| 195 | 38025 | 7414875 | 13.9642400 | 5.7988900 | .005128205 |
| 196 | 38416 | 7529536 | 14.0000000 | 5.8087857 | .005102041 |
| 197 | 38809 | 7645373 | 14.0356688 | 5.8186479 | .005076142 |
| 198 | 39204 | 7762392 | 14.0712473 | 5.8284767 | .005050505 |
| 199 | 39601 | 7880599 | 14.1067360 | 5.8382725 | .005025126 |
| 200 | 40000 | 8000000 | 14.1421356 | 5.8480355 | .005000000 |
| 201 | 40401 | 8120601 | 14.1774469 | 5.8577660 | .004975124 |
| 202 | 40804 | 8242408 | 14.2126704 | 5.8674643 | .004950495 |
| 203 | 41209 | 8365427 | 14.2478068 | 5.8771307 | .004926108 |
| 204 | 41616 | 8489664 | 14.2828569 | 5.8867653 | .004901961 |
| 205 | 42025 | 8615125 | 14.3178211 | 5.8963685 | .004878049 |
| 206 | 42436 | 8741816 | 14.3527001 | 5.9059406 | .004854369 |
| 207 | 42849 | 8869743 | 14.3874946 | 5.9154817 | .004830918 |
| 208 | 43264 | 8998912 | 14.4222051 | 5.9249921 | .004807692 |
| 209 | 43681 | 9129329 | 14.4568323 | 5.9344721 | .004784689 |
| 210 | 44100 | 9261000 | 14.4913767 | 5.9439220 | .004761905 |
| 211 | 44521 | 9393931 | 14.5258390 | 5.9533418 | .004739336 |
| 212 | 44944 | 9528128 | 14.5602198 | 5.9627320 | .004716981 |
| 213 | 45369 | 9663597 | 14.5945195 | 5.9720926 | .004694836 |
| 214 | 45796 | 9800344 | 14.6287388 | 5.9814240 | .004672897 |
| 215 | 46225 | 9938375 | 14.6628783 | 5.9907264 | .004651163 |
| 216 | 46656 | 10077696 | 14.6969385 | 6.0000000 | .004629630 |
| 217 | 47089 | 10218313 | 14.7309199 | 6.0092450 | .004608295 |
| 218 | 47524 | 10360232 | 14.7648231 | 6.0184617 | .004587156 |
| 219 | 47961 | 10503459 | 14.7986486 | 6.0276502 | .004566210 |
| 220 | 48400 | 10648000 | 14.8323970 | 6.0368107 | .004545455 |
| 221 | 48841 | 10793861 | 14.8660687 | 6.0459435 | .004524887 |
| 222 | 49284 | 10941048 | 14.8996644 | 6.0550489 | .004504505 |
| 223 | 49729 | 11089567 | 14.9331845 | 6.0641270 | .004484305 |
| 224 | 50176 | 11239424 | 14.9666295 | 6.0731779 | .004464286 |
| 225 | 50625 | 11390625 | 15.0000000 | 6.0822020 | .004444444 |
| 226 | 51076 | 11543176 | 15.0332964 | 6.0911994 | .004424779 |
| 227 | 51529 | 11697083 | 15.0665192 | 6.1001702 | .004405286 |
| 228 | 51984 | 11852352 | 15.0996689 | 6.1091147 | .004385965 |
| 229 | 52441 | 12008989 | 15.1327460 | 6.1180332 | .004366812 |
| 230 | 52900 | 12167000 | 15.1657509 | 6.1269257 | .004347826 |
| 231 | 53361 | 12326391 | 15.1986842 | 6.1357924 | .004329004 |
| 232 | 53824 | 12487168 | 15.2315462 | 6.1446337 | .004310345 |
| 233 | 54289 | 12649337 | 15.2643375 | 6.1534495 | .004291845 |
| 234 | 54756 | 12812904 | 15.2970585 | 6.1622401 | .004273504 |
| 235 | 55225 | 12977875 | 15.3297097 | 6.1710058 | .004255319 |
| 236 | 55696 | 13144256 | 15.3622915 | 6.1797466 | .004237288 |
| 237 | 56169 | 13312053 | 15.3948043 | 6.1884628 | .004219409 |
| 238 | 56644 | 13481272 | 15.4272486 | 6.1971544 | .004201681 |
| 239 | 57121 | 13651919 | 15.4596248 | 6.2058218 | .004184100 |
| 240 | 57600 | 13824000 | 15.4919334 | 6.2144650 | .004166667 |
| 241 | 58081 | 13997521 | 15.5241747 | 6.2230843 | .004149378 |
| 242 | 58564 | 14172488 | 15.5563492 | 6.2316797 | .004132231 |
| 243 | 59049 | 14348907 | 15.5884573 | 6.2402515 | .004115226 |
| 244 | 59536 | 14526784 | 15.6204994 | 6.2487998 | .004098361 |
| 245 | 60025 | 14706125 | 15.6524758 | 6.2573248 | .004081633 |
| 246 | 60516 | 14886936 | 15.6843871 | 6.2658266 | .004065041 |
| 247 | 61009 | 15069223 | 15.7162336 | 6.2743054 | .004048583 |
| 248 | 61504 | 15252992 | 15.7480157 | 6.2827613 | .004032258 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 249 | 62001 | 15438249 | 15.7797338 | 6.2911946 | .004016064 |
| 250 | 62500 | 15625000 | 15.8113883 | 6.2996053 | .004000000 |
| 251 | 63001 | 15813251 | 15.8429795 | 6.3079935 | .003984064 |
| 252 | 63504 | 16003008 | 15.8745079 | 6.3163596 | .003968254 |
| 253 | 64009 | 16194277 | 15.9059737 | 6.3247035 | .003952569 |
| 254 | 64516 | 16387064 | 15.9373775 | 6.3330256 | .003937008 |
| 255 | 65025 | 16581375 | 15.9687194 | 6.3413257 | .003921569 |
| 256 | 65536 | 16777216 | 16.0000000 | 6.3496042 | .003906250 |
| 257 | 66049 | 16974593 | 16.0312195 | 6.3578611 | .003891051 |
| 258 | 66564 | 17173512 | 16.0623784 | 6.3660968 | .003875969 |
| 259 | 67081 | 17373979 | 16.0934769 | 6.3743111 | .003861004 |
| 260 | 67600 | 17576000 | 16.1245155 | 6.3825043 | .003846154 |
| 261 | 68121 | 17779581 | 16.1554944 | 6.3906765 | .003831418 |
| 262 | 68644 | 17984728 | 16.1864141 | 6.3988279 | .003816794 |
| 263 | 69169 | 18191447 | 16.2172747 | 6.4069585 | .003802281 |
| 264 | 69696 | 18399744 | 16.2480768 | 6.4150687 | .003787879 |
| 265 | 70225 | 18609625 | 16.2788206 | 6.4231583 | .003773585 |
| 266 | 70756 | 18821096 | 16.3095064 | 6.4312276 | .003759398 |
| 267 | 71289 | 19034163 | 16.3401346 | 6.4392767 | .003745318 |
| 268 | 71824 | 19248832 | 16.3707055 | 6.4473057 | .003731343 |
| 269 | 72361 | 19465109 | 16.4012195 | 6.4553148 | .003717472 |
| 270 | 72900 | 19683000 | 16.4316767 | 6.4633041 | .003703704 |
| 271 | 73441 | 19902511 | 16.4620776 | 6.4712736 | .003690037 |
| 272 | 73984 | 20123648 | 16.4924225 | 6.4792236 | .003676471 |
| 273 | 74529 | 20346417 | 16.5227116 | 6.4871541 | .003663004 |
| 274 | 75076 | 20570824 | 16.5529454 | 6.4950653 | .003649635 |
| 275 | 75625 | 20796875 | 16.5831240 | 6.5029572 | .003636364 |
| 276 | 76176 | 21024576 | 16.6132477 | 6.5108300 | .003623188 |
| 277 | 76729 | 21253933 | 16.6433170 | 6.5186839 | .003610108 |
| 278 | 77284 | 21484952 | 16.6733320 | 6.5265189 | .003597122 |
| 279 | 77841 | 21717639 | 16.7032931 | 6.5343351 | .003584229 |
| 280 | 78400 | 21952000 | 16.7332005 | 6.5421326 | .003571429 |
| 281 | 78961 | 22188041 | 16.7630546 | 6.5499116 | .003558719 |
| 282 | 79524 | 22425768 | 16.7928556 | 6.5576722 | .003546099 |
| 283 | 80039 | 22665187 | 16.8226038 | 6.5654144 | .003533569 |
| 284 | 80656 | 22906304 | 16.8522995 | 6.5731385 | .003521127 |
| 285 | 81225 | 23149125 | 16.8819430 | 6.5808443 | .003508772 |
| 286 | 81796 | 23393656 | 16.9115345 | 6.5885323 | .003496503 |
| 287 | 82369 | 23639903 | 16.9410743 | 6.5962023 | .003484321 |
| 288 | 82944 | 23887872 | 16.9705527 | 6.6038545 | .003472222 |
| 289 | 83521 | 24137569 | 17.0000000 | 6.6114890 | .003460208 |
| 290 | 84100 | 24389000 | 17.0293864 | 6.6191060 | .003448276 |
| 291 | 84681 | 24642171 | 17.0587221 | 6.6267054 | .003436426 |
| 292 | 85264 | 24897088 | 17.0880075 | 6.6342874 | .003424658 |
| 293 | 85849 | 25153757 | 17.1172428 | 6.6418522 | .003412969 |
| 294 | 86436 | 25412184 | 17.1464282 | 6.6493998 | .003401361 |
| 295 | 87025 | 25672375 | 17.1755640 | 6.6569302 | .003389831 |
| 296 | 87616 | 25934336 | 17.2046505 | 6.6644437 | .003378378 |
| 297 | 88209 | 26198073 | 17.2336879 | 6.6719403 | .003367003 |
| 298 | 88804 | 26463592 | 17.2626765 | 6.6794200 | .003355705 |
| 299 | 89401 | 26730899 | 17.2916165 | 6.6868831 | .003344482 |
| 300 | 90000 | 27000000 | 17.3205081 | 6.6943295 | .003333333 |
| 301 | 90601 | 27270901 | 17.3493516 | 6.7017593 | .003322259 |
| 302 | 91204 | 27543608 | 17.3781472 | 6.7091729 | .003311258 |
| 303 | 91809 | 27818127 | 17.4068952 | 6.7165700 | .003300330 |
| 304 | 92416 | 28094464 | 17.4355958 | 6.7239508 | .003289474 |
| 305 | 93025 | 28372625 | 17.4642492 | 6.7313155 | .003278689 |
| 306 | 93636 | 28652616 | 17.4928557 | 6.7386641 | .003267974 |
| 307 | 94249 | 28934443 | 17.5214155 | 6.7459967 | .003257329 |
| 308 | 94864 | 29218112 | 17.5499288 | 6.7533134 | .003246753 |
| 309 | 95481 | 29503629 | 17.5783958 | 6.7606143 | .003236246 |
| 310 | 96100 | 29791000 | 17.6068169 | 6.7678995 | .003225806 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 311 | 96721 | 30080231 | 17.6351921 | 6.7751690 | .003215434 |
| 312 | 97344 | 30371328 | 17.6635217 | 6.7824229 | .003205128 |
| 313 | 97969 | 30664297 | 17.6918060 | 6.7896613 | .003194888 |
| 314 | 98596 | 30959144 | 17.7200451 | 6.7968844 | .003184713 |
| 315 | 99225 | 31255875 | 17.7482393 | 6.8040921 | .003174603 |
| 316 | 99856 | 31554496 | 17.7763888 | 6.8112847 | .003164557 |
| 317 | 100489 | 31855013 | 17.8044938 | 6.8184620 | .003154574 |
| 318 | 101124 | 32157432 | 17.8325545 | 6.8256242 | .003144654 |
| 319 | 101761 | 32461759 | 17.8605711 | 6.8327714 | .003134796 |
| 320 | 102400 | 32768000 | 17.8885438 | 6.8399037 | .003125000 |
| 321 | 103041 | 33076161 | 17.9164729 | 6.8470213 | .003115265 |
| 322 | 103684 | 33386248 | 17.9443584 | 6.8541240 | .003105590 |
| 323 | 104329 | 33698267 | 17.9722008 | 6.8612120 | .003095975 |
| 324 | 104976 | 34012224 | 18.0000000 | 6.8682855 | .003086420 |
| 325 | 105625 | 34328125 | 18.0277564 | 6.8753443 | .003076923 |
| 326 | 106276 | 34645976 | 18.0554701 | 6.8823888 | .003067485 |
| 327 | 106929 | 34965783 | 18.0831413 | 6.8894188 | .003058104 |
| 328 | 107584 | 35287552 | 18.1107703 | 6.8964345 | .003048780 |
| 329 | 108241 | 35611289 | 18.1383571 | 6.9034359 | .003039514 |
| 330 | 108900 | 35937000 | 18.1659021 | 6.9104232 | .003030303 |
| 331 | 109561 | 36264691 | 18.1934054 | 6.9173964 | .003021148 |
| 332 | 110224 | 36594368 | 18.2208672 | 6.9243556 | .003012048 |
| 333 | 110889 | 36926037 | 18.2482876 | 6.9313008 | .003003003 |
| 334 | 111556 | 37259704 | 18.2756669 | 6.9382321 | .002994012 |
| 335 | 112225 | 37595375 | 18.3030052 | 6.9451496 | .002985075 |
| 336 | 112896 | 37933056 | 18.3303028 | 6.9520533 | .002976190 |
| 337 | 113569 | 38272753 | 18.3575598 | 6.9589434 | .002967359 |
| 338 | 114244 | 38614472 | 18.3847763 | 6.9658198 | .002958580 |
| 339 | 114921 | 38958219 | 18.4119526 | 6.9726826 | .002949853 |
| 340 | 115600 | 39304000 | 18.4390889 | 6.9795321 | .002941176 |
| 341 | 116281 | 39651821 | 18.4661853 | 6.9863681 | .002932551 |
| 342 | 116964 | 40001688 | 18.4932420 | 6.9931906 | .002923977 |
| 343 | 117649 | 40353607 | 18.5202592 | 7.0000000 | .002915452 |
| 344 | 118336 | 40707584 | 18.5472370 | 7.0067962 | .002906977 |
| 345 | 119025 | 41063625 | 18.5741756 | 7.0135791 | .002898551 |
| 346 | 119716 | 41421736 | 18.6010752 | 7.0203490 | .002890173 |
| 347 | 120409 | 41781923 | 18.6279360 | 7.0271058 | .002881844 |
| 348 | 121104 | 42144192 | 18.6547581 | 7.0338497 | .002873563 |
| 349 | 121801 | 42508549 | 18.6815417 | 7.0405806 | .002865330 |
| 350 | 122500 | 42875000 | 18.7082869 | 7.0472987 | .002857143 |
| 351 | 123201 | 43243551 | 18.7349940 | 7.0540041 | .002849003 |
| 352 | 123904 | 43614208 | 18.7616630 | 7.0606967 | .002840909 |
| 353 | 124609 | 43986977 | 18.7882942 | 7.0673767 | .002832861 |
| 354 | 125316 | 44361864 | 18.8148877 | 7.0740440 | .002824859 |
| 355 | 126025 | 44738875 | 18.8414437 | 7.0806988 | .002816901 |
| 356 | 126736 | 45118016 | 18.8679623 | 7.0873411 | .002808989 |
| 357 | 127449 | 45499293 | 18.8944436 | 7.0939709 | .002801120 |
| 358 | 128164 | 45882712 | 18.9208879 | 7.1005885 | .002793216 |
| 359 | 128881 | 46268279 | 18.9472953 | 7.1071937 | .002785595 |
| 360 | 129600 | 46656000 | 18.9736660 | 7.1137866 | .002777778 |
| 361 | 130321 | 47045881 | 19.0000000 | 7.1203674 | .002770083 |
| 632 | 131044 | 47437928 | 19.0262976 | 7.1269360 | .002762431 |
| 363 | 131769 | 47832147 | 19.0525589 | 7.1334925 | .002754821 |
| 364 | 132496 | 48228544 | 19.0787840 | 7.1400370 | .002747253 |
| 365 | 133225 | 48627125 | 19.1049732 | 7.1465695 | .002739726 |
| 366 | 133956 | 49027896 | 19.1311265 | 7.1530901 | .002732240 |
| 367 | 134689 | 49430863 | 19.1572441 | 7.1595988 | .002724796 |
| 368 | 135424 | 49836032 | 19.1833261 | 7.1660957 | .002717391 |
| 369 | 136161 | 50243409 | 19.2093727 | 7.1725809 | .002710027 |
| 370 | 136900 | 50653000 | 19.2353841 | 7.1790544 | .002702708 |
| 371 | 137641 | 51064811 | 19.2613603 | 7.1855162 | .002695418 |
| 372 | 138384 | 51478848 | 19.2873015 | 7.1919663 | .002688172 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 373 | 139129 | 51895117 | 19.3132079 | 7.1984050 | .002680965 |
| 374 | 139876 | 52313624 | 19.3390796 | 7.2048322 | .002673797 |
| 375 | 140625 | 52734375 | 19.3649167 | 7.2112479 | .002666667 |
| 376 | 141376 | 53157376 | 19.3907194 | 7.2176522 | .002659574 |
| 377 | 142129 | 53582633 | 19.4164878 | 7.2240450 | 002652520 |
| 378 | 142884 | 54010152 | 19.4422221 | 7.2304268 | .002645503 |
| 379 | 143641 | 54439939 | 19.4679223 | 7.2367972 | .002638522 |
| 380 | 144400 | 54872000 | 19.4935887 | 7.2431565 | .002631579 |
| 381 | 145161 | 55306341 | 19.5192213 | 7.2495045 | .002624672 |
| 382 | 145924 | 55742968 | 19.5448203 | 7.2558415 | .002617801 |
| 383 | 146689 | 56181887 | 19.5703858 | 7.2621675 | .002610966 |
| 384 | 147456 | 56623104 | 19.5959179 | 7.2684824 | .002604167 |
| 385 | 148225 | 57066625 | 19.6214169 | 7.2747864 | .002597403 |
| 386 | 148996 | 57512456 | 19.6468827 | 7.2810794 | .002590674 |
| 387 | 149769 | 57960603 | 19.6723156 | 7.2873617 | .002583979 |
| 388 | 150544 | 58411072 | 19.6977156 | 7.2936330 | .002577320 |
| 389 | 151321 | 58863869 | 19.7230829 | 7.2998936 | .002570694 |
| 390 | 152100 | 59319000 | 19.7484177 | 7.3061436 | .002564103 |
| 391 | 152881 | 59776471 | 19.7737199 | 7.3123828 | .002557545 |
| 392 | 153664 | 60236288 | 19.7989899 | 7.3186114 | .002551020 |
| 393 | 154449 | 60698457 | 19.8242276 | 7.3248295 | .002544529 |
| 394 | 155236 | 61162984 | 19.8494332 | 7.3310369 | .002538071 |
| 395 | 156025 | 61629875 | 19.8746069 | 7.3372339 | .002531646 |
| 396 | 156816 | 62099136 | 19.8997487 | 7.3434205 | .002525253 |
| 397 | 157609 | 62570773 | 19.9248588 | 7.3495966 | .002518892 |
| 398 | 158404 | 63044792 | 19.9499373 | 7.3557624 | .002512563 |
| 399 | 159201 | 63521199 | 19.9749844 | 7.3619178 | .002506266 |
| 400 | 160000 | 64000000 | 20.0000000 | 7.3680630 | .002500000 |
| 401 | 160801 | 64481201 | 20.0249844 | 7.3741979 | .002493766 |
| 402 | 161604 | 64964808 | 20.0499377 | 7.3803227 | .002487562 |
| 403 | 162409 | 65450827 | 20.0748599 | 7.3864373 | .002481390 |
| 404 | 163216 | 65939264 | 20.0997512 | 7.3925418 | .002475248 |
| 405 | 164025 | 66430125 | 20.1246118 | 7.3986363 | .002469136 |
| 406 | 164836 | 66923416 | 20.1494417 | 7.4047206 | .002463054 |
| 407 | 165649 | 67419143 | 20.1742410 | 7.4107950 | .002457002 |
| 408 | 166464 | 67917312 | 20.1990099 | 7.4168595 | .002450980 |
| 409 | 167281 | 68417929 | 20.2237484 | 7.4229142 | .002444988 |
| 410 | 168100 | 68921000 | 20.2484567 | 7.4289589 | .002439024 |
| 411 | 168921 | 69426531 | 20.2731349 | 7.4349938 | .002433090 |
| 412 | 169744 | 69934528 | 20.2977831 | 7.4410189 | .002427184 |
| 413 | 170569 | 70444997 | 20.3224014 | 7.4470342 | .002421308 |
| 414 | 171396 | 70957944 | 20.3469899 | 7.4530399 | .002415459 |
| 415 | 172225 | 71473375 | 20.3715488 | 7.4590359 | .002409639 |
| 416 | 173056 | 71991296 | 20.3960781 | 7.4650223 | .002403846 |
| 417 | 173889 | 72511713 | 20.4205779 | 7.4709991 | .002398082 |
| 418 | 174724 | 73034632 | 20.4450483 | 7.4769664 | .002392344 |
| 419 | 175561 | 73560059 | 20.4694895 | 7.4829242 | .002386635 |
| 420 | 176400 | 74088000 | 20.4939015 | 7.4888724 | .002380952 |
| 421 | 177241 | 74618461 | 20.5182845 | 7.4948113 | .002375297 |
| 422 | 178084 | 75151448 | 20.5426386 | 7.5007406 | .002369668 |
| 423 | 178929 | 75686967 | 20.5669638 | 7.5066607 | .002364066 |
| 424 | 179776 | 76225024 | 20.5912603 | 7.5125715 | .002358491 |
| 425 | 180625 | 76765625 | 20.6155281 | 7.5184730 | .002352941 |
| 426 | 181476 | 77308776 | 20.6397674 | 7.5243652 | .002347418 |
| 427 | 182329 | 77854483 | 20.6639783 | 7.5302482 | .002341920 |
| 428 | 183184 | 78402752 | 20.6881609 | 7.5361221 | .002336449 |
| 429 | 184041 | 78953589 | 20.7123152 | 7.5419867 | .002331002 |
| 430 | 184900 | 79507000 | 20.7364414 | 7.5478423 | .002325581 |
| 431 | 185761 | 80062991 | 20.7605395 | 7.5536888 | .002320186 |
| 432 | 186624 | 80621568 | 20.7846097 | 7.5595263 | .002314815 |
| 433 | 187489 | 81182737 | 20.8086520 | 7.5653548 | .002309469 |
| 434 | 188356 | 81746504 | 20.8326667 | 7.5711743 | .002304147 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 435 | 189225 | 82312875 | 20.8566536 | 7.5769849 | .002298851 |
| 436 | 190096 | 82881856 | 20.8806130 | 7.5827865 | .002293578 |
| 437 | 190969 | 83453453 | 20.9045450 | 7.5885793 | .002288330 |
| 438 | 191844 | 84027672 | 20.9284495 | 7.5943633 | .002283105 |
| 439 | 192721 | 84604519 | 20.9523268 | 7.6001385 | .002277904 |
| 440 | 193600 | 85184000 | 20.9761770 | 7.6059049 | .002272727 |
| 441 | 194481 | 85766121 | 21.0000000 | 7.6116626 | .002267574 |
| 442 | 195364 | 86350888 | 21.0237960 | 7.6174116 | .002262443 |
| 443 | 196249 | 86938307 | 21.0475652 | 7.6231519 | .002257336 |
| 444 | 197136 | 87528384 | 21.0713075 | 7.6288837 | .002252252 |
| 445 | 198025 | 88121125 | 21.0950231 | 7.6346067 | .002247191 |
| 446 | 198916 | 88716536 | 21.1187121 | 7.6403213 | .002242152 |
| 447 | 199809 | 89314623 | 21.1423745 | 7.6460272 | .002237136 |
| 448 | 200704 | 89915392 | 21.1660105 | 7.6517247 | .002232143 |
| 449 | 201601 | 90518849 | 21.1896201 | 7.6574138 | .002227171 |
| 450 | 202500 | 91125000 | 21.2132034 | 7.6630943 | .002222222 |
| 451 | 203401 | 91733851 | 21.2367606 | 7.6687665 | .002217295 |
| 452 | 204304 | 92345408 | 21.2602916 | 7.6744303 | .002212389 |
| 453 | 205209 | 92959677 | 21.2837967 | 7.6800857 | .002207506 |
| 454 | 206116 | 93576664 | 21.3072758 | 7.6857328 | .002202643 |
| 455 | 207025 | 94196375 | 21.3307290 | 7.6913717 | .002197802 |
| 456 | 207936 | 94818816 | 21.3541565 | 7.6970023 | .002192982 |
| 457 | 208849 | 95443993 | 21.3775583 | 7.7026246 | .002188184 |
| 458 | 209764 | 96071912 | 21.4009346 | 7.7082388 | .002183406 |
| 459 | 210681 | 96702579 | 21.4242853 | 7.7138448 | .002178649 |
| 460 | 211600 | 97336000 | 21.4476106 | 7.7194426 | .002173913 |
| 461 | 212521 | 97972181 | 21.4709106 | 7.7250325 | .002169197 |
| 462 | 213444 | 98611128 | 21.4941853 | 7.7306141 | .002164502 |
| 463 | 214369 | 99252847 | 21.5174348 | 7.7361877 | .002159827 |
| 464 | 215296 | 99897344 | 21.5406592 | 7.7417532 | .002155172 |
| 465 | 216225 | 100544625 | 21.5638587 | 7.7473109 | .002150538 |
| 466 | 217156 | 101194696 | 21.5870331 | 7.7528606 | .002145923 |
| 467 | 218089 | 101847563 | 21.6101828 | 7.7584023 | .002141328 |
| 468 | 219024 | 102503232 | 21.6333077 | 7.7639361 | .002136752 |
| 469 | 219961 | 103161709 | 21.6564078 | 7.7694620 | .002132196 |
| 470 | 220900 | 103823000 | 21.6794834 | 7.7749801 | .002127660 |
| 471 | 221841 | 104487111 | 21.7025344 | 7.7804904 | .002123142 |
| 472 | 222784 | 105154048 | 21.7255610 | 7.7859928 | .002118644 |
| 473 | 223729 | 105823817 | 21.7485632 | 7.7914875 | .002114165 |
| 474 | 224676 | 106496424 | 21.7715411 | 7.7969745 | .002109705 |
| 475 | 225625 | 107171875 | 21.7944947 | 7.8024538 | .002105263 |
| 476 | 226576 | 107850176 | 21.8174242 | 7.8079254 | .002100840 |
| 477 | 227529 | 108531333 | 21.8403297 | 7.8133892 | .002096436 |
| 478 | 228484 | 109215352 | 21.8632111 | 7.8188456 | .002092050 |
| 479 | 229441 | 109902239 | 21.8860686 | 7.8242942 | .002087683 |
| 480 | 230400 | 110592000 | 21.9089023 | 7.8297353 | .002083333 |
| 481 | 231361 | 111284641 | 21.9317122 | 7.8351688 | .002079002 |
| 482 | 232324 | 111980168 | 21.9544984 | 7.8405949 | .002074689 |
| 483 | 233289 | 112678587 | 21.9772610 | 7.8460134 | .002070393 |
| 484 | 234256 | 113379904 | 22.0000000 | 5.8514244 | .002066116 |
| 485 | 235225 | 114084125 | 22.0227155 | 7.8568281 | .002061856 |
| 486 | 236196 | 114791256 | 22.0454077 | 7.8622242 | .002057613 |
| 487 | 237169 | 115501303 | 22.0680765 | 7.8676130 | .002053388 |
| 488 | 238144 | 116214272 | 22.0907220 | 7.8729944 | .002049180 |
| 489 | 239121 | 116930169 | 22.1133444 | 7.8783684 | .002044990 |
| 490 | 240100 | 117649000 | 22.1359436 | 7.8837352 | .002040816 |
| 491 | 241081 | 118370771 | 22.1585198 | 7.8890946 | .002036660 |
| 492 | 242064 | 119095488 | 22.1810730 | 7.8944468 | .002032520 |
| 493 | 243049 | 119823157 | 22.2036033 | 7.8997917 | .002028398 |
| 494 | 244036 | 120553784 | 22.2261108 | 7.9051294 | .002024291 |
| 495 | 245025 | 121287375 | 22.2485955 | 7.9104599 | .002020202 |
| 496 | 246016 | 122023936 | 22.2710575 | 7.9157832 | .002016129 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 497 | 247009 | 122763473 | 22.2934968 | 7.9210994 | .002012072 |
| 498 | 248004 | 123505992 | 22.3159136 | 7.9264085 | .002008032 |
| 499 | 249001 | 124251499 | 22.3383079 | 7.9317104 | .002004008 |
| 500 | 250000 | 125000000 | 22.3606798 | 7.9370053 | .002000000 |
| 501 | 251001 | 125751501 | 22.3830293 | 7.9422931 | .001996008 |
| 502 | 252004 | 126506008 | 22.4053565 | 7.9475739 | .001992032 |
| 503 | 253009 | 127263527 | 22.4276615 | 7.9528477 | .001988072 |
| 504 | 254016 | 128024064 | 22.4499443 | 7.9581144 | .001984127 |
| 505 | 255025 | 128787625 | 22.4722051 | 7.9633743 | .001980198 |
| 506 | 256036 | 129554216 | 22.4944438 | 7.9686271 | .001976285 |
| 507 | 257049 | 130323843 | 22.5166605 | 7.9738731 | .001972387 |
| 508 | 258064 | 131096512 | 22.5388553 | 7.9791122 | .001968504 |
| 509 | 259081 | 131872229 | 22.5610283 | 7.9843444 | .001964637 |
| 510 | 260100 | 132651000 | 22.5831796 | 7.9895697 | .001960784 |
| 511 | 261121 | 133432831 | 22.6053091 | 7.9947883 | .001956947 |
| 512 | 262144 | 134217728 | 22.6274170 | 8.0000000 | .001953125 |
| 513 | 263169 | 135005697 | 22.6495033 | 8.0052049 | .001949318 |
| 514 | 264196 | 135796744 | 22.6715681 | 8.0104032 | .001945525 |
| 515 | 265225 | 136590875 | 22.6936114 | 8.0155946 | .001941748 |
| 516 | 266256 | 137388096 | 22.7156334 | 8.0207794 | .001937984 |
| 517 | 267289 | 138188413 | 22.7376340 | 8.0259574 | .001934236 |
| 518 | 268324 | 138991832 | 22.7596134 | 8.0311287 | .001930502 |
| 519 | 269361 | 139798359 | 22.7815715 | 8.0362935 | .001926782 |
| 520 | 270400 | 140608000 | 22.8035085 | 8.0414515 | .001923077 |
| 521 | 271441 | 141420761 | 22.8254244 | 8.0466030 | .001919386 |
| 522 | 272484 | 142236648 | 22.8473193 | 8.0517479 | .001915709 |
| 523 | 273529 | 143055667 | 22.8691933 | 8.0568862 | .001912046 |
| 524 | 274576 | 143877824 | 22.8910463 | 8.0620180 | .001908397 |
| 525 | 275625 | 144703125 | 22.9128785 | 8.0671432 | .001904762 |
| 526 | 276676 | 145531576 | 22.9346899 | 8.0722620 | .001901141 |
| 527 | 277729 | 146363183 | 22.9564806 | 8.0773743 | .001897533 |
| 528 | 278784 | 147197952 | 22.9782506 | 8.0824800 | .001893939 |
| 529 | 279841 | 148035889 | 23.0000000 | 8.0875794 | .001890359 |
| 530 | 280900 | 148877000 | 23.0217289 | 8.0926723 | .001886792 |
| 531 | 281961 | 149721291 | 23.0434372 | 8.0977589 | .001883239 |
| 532 | 283024 | 150568768 | 23.0651252 | 8.1028390 | .001879699 |
| 533 | 284089 | 151419437 | 23.0867928 | 8.1079128 | .001876173 |
| 534 | 285156 | 152273304 | 23.1084400 | 8.1129803 | .001872659 |
| 535 | 286225 | 153130375 | 23.1300670 | 8.1180414 | .001869159 |
| 536 | 287296 | 153990656 | 23.1516738 | 8.1230962 | .001865672 |
| 537 | 288369 | 154854153 | 23.1732605 | 8.1281447 | .001862197 |
| 538 | 289444 | 155720872 | 23.1948270 | 8.1331870 | .001858736 |
| 539 | 290521 | 156590819 | 23.2163735 | 8.1382230 | .001855288 |
| 540 | 291600 | 157464000 | 23.2379001 | 8.1432529 | .001851852 |
| 541 | 292681 | 158340421 | 23.2594067 | 8.1482765 | .001848429 |
| 542 | 293764 | 159220088 | 23.2808935 | 8.1532939 | .001845018 |
| 543 | 294849 | 160103007 | 23.3023604 | 8.1583051 | .001841621 |
| 544 | 295936 | 160989184 | 23.3238076 | 8.1633102 | .001838235 |
| 545 | 297025 | 161878625 | 23.3452351 | 8.1683092 | .001834862 |
| 546 | 298116 | 162771336 | 23.3666429 | 8.1733020 | .001831502 |
| 547 | 299209 | 163667323 | 23.3880311 | 8.1782888 | .001828154 |
| 548 | 300304 | 164566592 | 23.4093998 | 8.1832695 | .001824818 |
| 549 | 301401 | 165469149 | 23.4307490 | 8.1882441 | .001821494 |
| 550 | 302500 | 166375000 | 23.4520788 | 8.1932127 | .001818182 |
| 551 | 303601 | 167284151 | 23.4733892 | 8.1981753 | .001814882 |
| 552 | 304704 | 168196608 | 23.4946802 | 8.2031319 | .001811594 |
| 553 | 305809 | 169112377 | 23.5159520 | 8.2080825 | .001808318 |
| 554 | 306916 | 170031464 | 23.5372046 | 8.2130271 | .001805054 |
| 555 | 308025 | 170953875 | 23.5584380 | 8.2179657 | .001801802 |
| 556 | 309136 | 171879616 | 23.5796522 | 8.2228985 | .001798561 |
| 557 | 310249 | 172808693 | 23.6008474 | 8.2278254 | .001795332 |
| 558 | 311364 | 173741112 | 23.6220236 | 8.2327463 | .001792115 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 559 | 312481 | 174676879 | 23.6431808 | 8.2376614 | .001788909 |
| 560 | 313600 | 175616000 | 23.6643191 | 8.2425706 | .001785714 |
| 561 | 314721 | 176558481 | 23.6854386 | 8.2474740 | .001782531 |
| 562 | 315844 | 177504328 | 23.7065392 | 8.2523715 | .001779359 |
| 563 | 316969 | 178453547 | 23.7276210 | 8.2572633 | .001776199 |
| 564 | 318096 | 179406144 | 23.7486842 | 8.2621492 | .001773050 |
| 565 | 319225 | 180362125 | 23.7697286 | 8.2670294 | .001769912 |
| 566 | 320356 | 181321496 | 23.7907545 | 8.2719039 | .001766784 |
| 567 | 321489 | 182284263 | 23.8117618 | 8.2767726 | .001763668 |
| 568 | 322624 | 183250432 | 23.8327506 | 8.2816355 | .001760563 |
| 569 | 323761 | 184220000 | 23.8537209 | 8.2864928 | .001757469 |
| 570 | 324900 | 185193000 | 23.8746728 | 8.2913444 | .001754386 |
| 571 | 326041 | 186169411 | 23.8956063 | 8.2961903 | .001751313 |
| 572 | 327184 | 187149248 | 23.9165215 | 8.3010304 | .001748252 |
| 573 | 328329 | 188132517 | 23.9374184 | 8.3058651 | .001745201 |
| 574 | 329476 | 189119224 | 23.9582971 | 8.3106941 | .001742160 |
| 575 | 330625 | 190109375 | 23.9791576 | 8.3155175 | .001739130 |
| 576 | 331776 | 191102976 | 24.0000000 | 8.3203353 | .001736111 |
| 577 | 332929 | 192100033 | 24.0208243 | 8.3251475 | .001733102 |
| 578 | 334084 | 193100552 | 24.0416306 | 8.3299542 | .001730104 |
| 579 | 335241 | 194104539 | 24.0624188 | 8.3347553 | .001727116 |
| 580 | 336400 | 195112000 | 24.0831891 | 8.3395509 | .001724138 |
| 581 | 337561 | 196122941 | 24.1039416 | 8.3443410 | .001721170 |
| 582 | 338724 | 197137368 | 24.1246762 | 8.3491256 | .001718213 |
| 583 | 339889 | 198155287 | 24.1453929 | 8.3539047 | .001715266 |
| 584 | 341056 | 199176704 | 24.1660919 | 8.3586784 | .001712329 |
| 585 | 342225 | 200201625 | 24.1867732 | 8.3634466 | .001709402 |
| 586 | 343396 | 201230056 | 24.2074369 | 8.3682095 | .001706485 |
| 587 | 344569 | 202262003 | 24.2280829 | 8.3729668 | .001703578 |
| 588 | 345744 | 203297472 | 24.2487113 | 8.3777188 | .001700680 |
| 589 | 346921 | 204336469 | 24.2693222 | 8.3824653 | .001697793 |
| 590 | 348100 | 205379000 | 24.2899156 | 8.3872065 | .001694915 |
| 591 | 349281 | 206425071 | 24.3104916 | 8.3919423 | .001692047 |
| 592 | 350464 | 207474688 | 24.3310501 | 8.3966729 | .001689189 |
| 593 | 351649 | 208527857 | 24.3515913 | 8.4013981 | .001686341 |
| 594 | 352836 | 209584584 | 24.3721152 | 8.4061180 | .001683502 |
| 595 | 354025 | 210644875 | 24.3926218 | 8.4108326 | .001680672 |
| 596 | 355216 | 211708736 | 24.4131112 | 8.4155419 | .001677852 |
| 597 | 356409 | 212776173 | 24.4335834 | 8.4202460 | .001675042 |
| 598 | 357604 | 213847192 | 24.4540385 | 8.4249448 | .001672241 |
| 599 | 358801 | 214921799 | 24.4744765 | 8.4296383 | .001669449 |
| 600 | 360000 | 216000000 | 24.4948974 | 8.4343267 | .001666667 |
| 601 | 361201 | 217081801 | 24.5153013 | 8.4390098 | .001663894 |
| 602 | 362404 | 218167208 | 24.5356883 | 8.4436877 | .001661130 |
| 603 | 363609 | 219256227 | 24.5560583 | 8.4483605 | .001658375 |
| 604 | 364816 | 220348864 | 24.5764115 | 8.4530281 | .001655629 |
| 605 | 366025 | 221445125 | 24.5967478 | 8.4576906 | .001652893 |
| 606 | 367236 | 222545016 | 24.6170673 | 8.4623479 | .001650165 |
| 607 | 368449 | 223648543 | 24.6373700 | 8.4670001 | .001647446 |
| 608 | 369664 | 224755712 | 24.6576560 | 8.4716471 | .001644737 |
| 609 | 370881 | 225866529 | 24.6779254 | 8.4762892 | .001642036 |
| 610 | 372100 | 226981000 | 24.6981781 | 8.4809261 | .001639344 |
| 611 | 373321 | 228099131 | 24.7184142 | 8.4855579 | .001636661 |
| 612 | 374544 | 229220928 | 24.7386338 | 8.4901848 | .001633987 |
| 613 | 375769 | 230346397 | 24.7588368 | 8.4948065 | .001631321 |
| 614 | 376996 | 231475544 | 24.7790234 | 8.4994233 | .001628664 |
| 615 | 378225 | 232608375 | 24.7991935 | 8.5040350 | .001626016 |
| 616 | 379456 | 233744896 | 24.8193473 | 8.5086417 | .001623377 |
| 617 | 380689 | 234885113 | 24.8394847 | 8.5132435 | .001620746 |
| 618 | 381924 | 236029032 | 24.8596058 | 8.5178403 | .001618123 |
| 619 | 383161 | 237176659 | 24.8797106 | 8.5224321 | .001615509 |
| 620 | 384400 | 238328000 | 24.8997992 | 8.5270189 | .001612903 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 621 | 385641 | 239483061 | 24.9198716 | 8.5316009 | .001610306 |
| 622 | 386884 | 240641848 | 24.9399278 | 8.5361780 | .001607717 |
| 623 | 388129 | 241804367 | 24.9599679 | 8.5407501 | .001605136 |
| 624 | 389376 | 242970624 | 24.9799920 | 8.5453173 | .001602564 |
| 625 | 390625 | 244140625 | 25.0000000 | 8.5498797 | .001600000 |
| 626 | 391876 | 245314376 | 25.0199920 | 8.5544372 | .001597444 |
| 627 | 393129 | 246491883 | 25.0399681 | 8.5589899 | .001594896 |
| 628 | 394384 | 247673152 | 25.0599282 | 8.5635377 | .001592357 |
| 629 | 395641 | 248858189 | 25.0798724 | 8.5680807 | .001589825 |
| 630 | 396900 | 250047000 | 25.0998008 | 8.5726189 | .001587302 |
| 631 | 398161 | 251239591 | 25.1197134 | 8.5771523 | .001584786 |
| 632 | 399424 | 252435968 | 25.1396102 | 8.5816809 | .001582278 |
| 633 | 400689 | 253636137 | 25.1594913 | 8.5862047 | .001579779 |
| 634 | 401956 | 254840104 | 25.1793566 | 8.5907238 | .001577287 |
| 635 | 403225 | 256047875 | 25.1992063 | 8.5952380 | .001574803 |
| 636 | 404496 | 257259456 | 25.2190404 | 8.5997476 | .001572327 |
| 637 | 405769 | 258474853 | 25.2388589 | 8.6042525 | .001569859 |
| 638 | 407044 | 259694072 | 25.2586619 | 8.6087526 | .001567398 |
| 639 | 408321 | 260917119 | 25.2784493 | 8.6132480 | .001564945 |
| 640 | 409600 | 262144000 | 25.2982213 | 8.6177388 | .001562500 |
| 641 | 410881 | 263374721 | 25.3179778 | 8.6222248 | .001560062 |
| 642 | 412164 | 264609288 | 25.3377189 | 8.6267063 | .001557632 |
| 643 | 413449 | 265847707 | 25.3574447 | 8.6311830 | .001555210 |
| 644 | 414736 | 267089984 | 25.3771551 | 8.6356551 | .001552795 |
| 645 | 416025 | 268336125 | 25.3968502 | 8.6401226 | .001550388 |
| 646 | 417316 | 269586136 | 25.4165301 | 8.6445855 | .001547988 |
| 647 | 418609 | 270840023 | 25.4361947 | 8.6490437 | .001545595 |
| 648 | 419904 | 272097792 | 25.4558441 | 8.6534974 | .001543210 |
| 649 | 421201 | 273359449 | 25.4754784 | 8.6579465 | .001540832 |
| 650 | 422500 | 274625000 | 25.4950976 | 8.6623911 | .001538462 |
| 651 | 423801 | 275894451 | 25.5147016 | 8.6668310 | .001536098 |
| 652 | 425104 | 277167808 | 25.5342907 | 8.6712665 | .001533742 |
| 653 | 426409 | 278445077 | 25.5538647 | 8.6756974 | .001531394 |
| 654 | 427716 | 279726264 | 25.5734237 | 8.6801237 | .001529052 |
| 655 | 429025 | 281011375 | 25.5929678 | 8.6845456 | .001526718 |
| 656 | 430336 | 282300416 | 25.6124969 | 8.6889630 | .001524390 |
| 657 | 431649 | 283593393 | 25.6320112 | 8.6933759 | .001522070 |
| 658 | 432964 | 284890312 | 25.6515107 | 8.6977843 | .001519757 |
| 659 | 434281 | 286191179 | 25.6709953 | 8.7021882 | .001517451 |
| 660 | 435600 | 287496000 | 25.6904652 | 8.7065877 | .001515152 |
| 661 | 436921 | 288804781 | 25.7099203 | 8.7109827 | .001512859 |
| 662 | 438244 | 290117528 | 25.7293607 | 8.7153734 | .001510574 |
| 663 | 439569 | 291434247 | 25.7487864 | 8.7197596 | .001508296 |
| 664 | 440896 | 292754944 | 25.7681975 | 8.7241414 | .001506024 |
| 665 | 442225 | 294079525 | 25.7875939 | 8.7285187 | .001503759 |
| 666 | 443556 | 295408296 | 25.8069758 | 8.7328918 | .001501502 |
| 667 | 444889 | 296740963 | 25.8263431 | 8.7372604 | .001499250 |
| 668 | 446224 | 298077632 | 25.8456960 | 8.7416246 | .001497006 |
| 669 | 447561 | 299418309 | 25.8650343 | 8.7459846 | .001494768 |
| 670 | 448900 | 300763000 | 25.8843582 | 8.7503401 | .001492537 |
| 671 | 450241 | 302111711 | 25.9036677 | 8.7546913 | .001490313 |
| 672 | 451584 | 303464448 | 25.9229628 | 8.7590383 | .001488095 |
| 673 | 452929 | 304821217 | 25.9422435 | 8.7633809 | .001485884 |
| 674 | 454276 | 306182024 | 25.9615100 | 8.7677192 | .001483680 |
| 675 | 455625 | 307546875 | 25.9807621 | 8.7720532 | .001481481 |
| 676 | 456976 | 308915776 | 26.0000000 | 8.7763830 | .001479290 |
| 677 | 458329 | 310288733 | 26.0192237 | 8.7807084 | .001477105 |
| 678 | 459684 | 311665752 | 26.0384331 | 8.7850296 | .001474926 |
| 679 | 461041 | 313046839 | 26.0576284 | 8.7893466 | .004472754 |
| 680 | 462400 | 314432000 | 26.0768096 | 8.7936593 | .001470588 |
| 681 | 463761 | 315821241 | 26.0959767 | 8.7979679 | .001468429 |
| 682 | 465124 | 317214568 | 26.1151297 | 8.8022721 | .001466276 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 683 | 466489 | 318611987 | 26.1342687 | 8.8065722 | .001464129 |
| 684 | 467856 | 320013504 | 26.1533937 | 8.8108681 | .001461988 |
| 685 | 469225 | 321419125 | 26.1725047 | 8.8151598 | .001459854 |
| 686 | 470596 | 322828856 | 26.1916017 | 8.8194474 | .001457726 |
| 687 | 471969 | 324242703 | 26.2106848 | 8.8237307 | .001455604 |
| 688 | 473344 | 325660672 | 26.2297541 | 8.8280099 | .001453488 |
| 689 | 474721 | 327082769 | 26.2488095 | 8.8322850 | .001451379 |
| 690 | 476100 | 328509000 | 26.2678511 | 8.8365559 | .001449275 |
| 691 | 477481 | 329939371 | 26.2868789 | 8.8408227 | .001447178 |
| 692 | 478864 | 331373888 | 26.3058929 | 8.8450854 | .001445087 |
| 693 | 480249 | 332812557 | 26.3248932 | 8.8493440 | .001443001 |
| 694 | 481636 | 334255384 | 26.3438797 | 8.8535985 | .001440922 |
| 695 | 483025 | 335702375 | 26.3628527 | 8.8578489 | .001438849 |
| 696 | 484416 | 337153536 | 26.3818119 | 8.8620952 | .001436782 |
| 697 | 485809 | 338608873 | 26.4007576 | 8.8663375 | .001434720 |
| 698 | 487204 | 340068392 | 26.4196896 | 8.8705757 | .001432665 |
| 699 | 488601 | 341532099 | 26.4386081 | 8.8748099 | .001430615 |
| 700 | 490000 | 343000000 | 26.4575131 | 8.8790400 | .001428571 |
| 701 | 491401 | 344472101 | 26.4764046 | 8.8832661 | .001426534 |
| 702 | 492804 | 345948408 | 26.4952826 | 8.8874882 | .001424501 |
| 703 | 494209 | 347428927 | 26.5141472 | 8.8917063 | .001422475 |
| 704 | 495616 | 348913664 | 26.5329983 | 8.8959204 | .001420455 |
| 705 | 497025 | 350402625 | 26.5518361 | 8.9001304 | .001418440 |
| 706 | 498436 | 351895816 | 26.5706605 | 8.9043366 | .001416431 |
| 707 | 499849 | 353393243 | 26.5894716 | 8.9085387 | .001414427 |
| 708 | 501264 | 354894912 | 26.6082694 | 8.9127369 | .001412429 |
| 709 | 502681 | 356400829 | 26.6270539 | 8.9169311 | .001410437 |
| 710 | 504100 | 357911000 | 26.6458252 | 8.9211214 | .001408451 |
| 711 | 505521 | 359425431 | 26.6645833 | 8.9253078 | .001406470 |
| 712 | 506944 | 360944128 | 26.6833281 | 8.9294902 | .001404494 |
| 713 | 508369 | 362467097 | 26.7020598 | 8.9336687 | .001402525 |
| 714 | 509796 | 363994344 | 26.7207784 | 8.9378433 | .001400560 |
| 715 | 511225 | 365525875 | 26.7394839 | 8.9420140 | .001398601 |
| 716 | 512656 | 367061696 | 26.7581763 | 8.9461809 | .001396648 |
| 717 | 514089 | 368601813 | 26.7768557 | 8.9503438 | .001394700 |
| 718 | 515524 | 370146232 | 26.7955220 | 8.9545029 | .001392758 |
| 719 | 516961 | 371694959 | 26.8141754 | 8.9586581 | .001390821 |
| 720 | 518400 | 373248000 | 26.8328157 | 8.9628095 | .001388889 |
| 721 | 519841 | 374805361 | 26.8514432 | 8.9669570 | .001386963 |
| 722 | 521284 | 376367048 | 26.8700577 | 8.9711007 | .001385042 |
| 723 | 522729 | 377933067 | 26.8886593 | 8.9752406 | .001383126 |
| 724 | 524176 | 379503424 | 26.9072481 | 8.9793766 | .001381215 |
| 725 | 525625 | 381078125 | 26.9258240 | 8.9835089 | .001379310 |
| 726 | 527076 | 382657176 | 26.9443872 | 8.9876373 | .001377410 |
| 727 | 528529 | 384240583 | 26.9629375 | 8.9917620 | .001375516 |
| 728 | 529984 | 385828352 | 26.9814751 | 8.9958829 | .001373626 |
| 729 | 531441 | 387420489 | 27.0000000 | 9.0000000 | .001371742 |
| 730 | 532900 | 389017000 | 27.0185122 | 9.0041134 | .001369863 |
| 731 | 534361 | 390617891 | 27.0370117 | 9.0082229 | .001367989 |
| 732 | 535824 | 392223168 | 27.0554985 | 9.0123288 | .001366120 |
| 733 | 537289 | 393832837 | 27.0739727 | 9.0164309 | .001364256 |
| 734 | 538756 | 395446904 | 27.0924344 | 9.0205293 | .001362398 |
| 735 | 540225 | 397065375 | 27.1108834 | 9.0246239 | .001360544 |
| 736 | 541696 | 398688256 | 27.1293199 | 9.0287149 | .001358696 |
| 737 | 543169 | 400315553 | 27.1477439 | 9.0328021 | .001356852 |
| 738 | 544644 | 401947272 | 27.1661554 | 9.0368857 | .001355014 |
| 739 | 546121 | 403583419 | 27.1845544 | 9.0409655 | .001353180 |
| 740 | 547600 | 405224000 | 27.2029410 | 9.0450419 | .001351351 |
| 741 | 549081 | 406869021 | 27.2213152 | 9.0491142 | .001349528 |
| 742 | 550564 | 408518488 | 27.2396769 | 9.0531831 | .001347709 |
| 743 | 552049 | 410172407 | 27.2580263 | 9.0572482 | .001345895 |
| 744 | 553536 | 411830784 | 27.2763634 | 9.0613098 | .001344086 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 745 | 555025 | 413493625 | 27.2946881 | 9.0653677 | .001342282 |
| 746 | 556516 | 415160936 | 27.3130006 | 9.0694220 | .001340483 |
| 747 | 558009 | 416832723 | 27.3313007 | 9.0734726 | .001338688 |
| 748 | 559504 | 418508992 | 27.3495887 | 9.0775197 | .001336898 |
| 749 | 561001 | 420189749 | 27.3678644 | 9.0815631 | .001335113 |
| 750 | 562500 | 421875000 | 27.3861279 | 9.0856030 | .001333333 |
| 751 | 564001 | 423564751 | 27.4043792 | 9.0896392 | .001331558 |
| 752 | 565504 | 425259008 | 27.4226184 | 9.0936719 | .001329787 |
| 753 | 567009 | 426957777 | 27.4408455 | 9.0977010 | .001328021 |
| 754 | 568516 | 428661064 | 27.4590604 | 9.1017265 | .001326260 |
| 755 | 570025 | 430368875 | 27.4772633 | 9.1057485 | .001324503 |
| 756 | 571536 | 432081216 | 27.4954542 | 9.1097669 | .001322751 |
| 757 | 573049 | 433798093 | 27.5136330 | 9.1137818 | .001321004 |
| 758 | 574564 | 435519512 | 27.5317998 | 9.1177931 | .001319261 |
| 759 | 576081 | 437245479 | 27.5499546 | 9.1218010 | .001317523 |
| 760 | 577600 | 438976000 | 27.5680975 | 9.1258053 | .001315789 |
| 761 | 579121 | 440711081 | 27.5862284 | 9.1298061 | .001314060 |
| 762 | 580644 | 442450728 | 27.6043475 | 9.1338034 | .001312336 |
| 763 | 582169 | 444194947 | 27.6224546 | 9.1377971 | .001310616 |
| 764 | 583696 | 445943744 | 27.6405499 | 9.1417874 | .001308901 |
| 765 | 585225 | 447697125 | 27.6586334 | 9.1457742 | .001307190 |
| 766 | 586756 | 449455096 | 27.6767050 | 9.1497576 | .001305483 |
| 767 | 588289 | 451217663 | 27.6947648 | 9.1537375 | .001303781 |
| 768 | 589824 | 452984832 | 27.7128129 | 9.1577139 | .001302083 |
| 769 | 591361 | 454756609 | 27.7308492 | 9.1616869 | .001300390 |
| 770 | 592900 | 456533000 | 27.7488739 | 9.1656565 | .001298701 |
| 771 | 594441 | 458314011 | 27.7668808 | 9.1696225 | .001297017 |
| 772 | 595984 | 460099648 | 27.7848880 | 9.1735852 | .001295337 |
| 773 | 597529 | 461889917 | 27.8028775 | 9.1775445 | .001293661 |
| 774 | 599076 | 463684824 | 27.8208555 | 9.1815003 | .001291990 |
| 775 | 600625 | 465484375 | 27.8388218 | 9.1854527 | .001290323 |
| 776 | 602176 | 467288576 | 27.8567766 | 9.1894018 | .001288660 |
| 777 | 603729 | 469097433 | 27.8747197 | 9.1933474 | .001287001 |
| 778 | 605284 | 470910952 | 27.8926514 | 9.1972897 | .001285347 |
| 779 | 606841 | 472729139 | 27.9105715 | 9.2012286 | .001283697 |
| 780 | 608400 | 474552000 | 27.9284801 | 9.2051641 | .001282051 |
| 781 | 609961 | 476379541 | 27.9463772 | 9.2090962 | .001280410 |
| 782 | 611524 | 478211768 | 27.9642629 | 9.2130250 | .001278772 |
| 783 | 613089 | 480048687 | 27.9821372 | 9.2169505 | .001277139 |
| 784 | 614656 | 481890304 | 28.0000000 | 9.2208726 | .001275510 |
| 785 | 616225 | 483736625 | 28.0178515 | 9.2247914 | .001273885 |
| 786 | 617796 | 485587656 | 28.0356915 | 9.2287068 | .001272265 |
| 787 | 619369 | 487443403 | 28.0535203 | 9.2326189 | .001270648 |
| 788 | 620944 | 489303872 | 28.0713377 | 9.2365277 | .001269036 |
| 789 | 622521 | 491169069 | 28.0891438 | 9.2404333 | .001267427 |
| 790 | 624100 | 493039000 | 28.1069386 | 9.2443355 | .001265823 |
| 791 | 625681 | 494913671 | 28.1247222 | 9.2482344 | .001264223 |
| 792 | 627264 | 496793088 | 28.1424946 | 9.2521300 | .001262626 |
| 793 | 628849 | 498677257 | 28.1602557 | 9.2560224 | .001261034 |
| 794 | 630436 | 500566184 | 28.1780056 | 9.2599114 | .001259446 |
| 795 | 632025 | 502459875 | 28.1957444 | 9.2637973 | .001257862 |
| 796 | 633616 | 504358336 | 28.2134720 | 9.2676798 | .001256281 |
| 797 | 635209 | 506261573 | 28.2311884 | 9.2715592 | .001254705 |
| 798 | 636804 | 508169592 | 28.2488938 | 9.2754352 | .001253133 |
| 799 | 638401 | 510082399 | 28.2665881 | 9.2793081 | .001251564 |
| 800 | 640000 | 512000000 | 28.2842712 | 9.2831777 | .001250000 |
| 801 | 641601 | 513922401 | 28.3019434 | 9.2870440 | .001248439 |
| 802 | 643204 | 515849608 | 28.3196045 | 9.2909072 | .001246883 |
| 803 | 644809 | 517781627 | 28.3372546 | 9.2947671 | .001245330 |
| 804 | 646416 | 519718464 | 28.3548938 | 9.2986239 | .001243781 |
| 805 | 648025 | 521660125 | 28.3725219 | 9.3024775 | .001242236 |
| 806 | 649636 | 523606616 | 28.3901391 | 9.3063278 | .001240695 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 807 | 651249 | 525557943 | 28.4077454 | 9.3101750 | .001239157 |
| 808 | 652864 | 527514112 | 28.4253408 | 9.3140190 | .001237624 |
| 809 | 654481 | 529475129 | 28.4429253 | 9.3178599 | .001236094 |
| 810 | 656100 | 531441000 | 28.4604989 | 9.3216975 | .001234568 |
| 811 | 657721 | 533411731 | 28.4780617 | 9.3255320 | .001233046 |
| 812 | 659344 | 535387328 | 28.4956137 | 9.3293634 | .001231527 |
| 813 | 660969 | 537367797 | 28.5131549 | 9.3331916 | .001230012 |
| 814 | 662596 | 539353144 | 28.5306852 | 9.3370167 | .001228501 |
| 815 | 664225 | 541343375 | 28.5482048 | 9.3408386 | .001226994 |
| 816 | 665856 | 543338496 | 28.5657137 | 9.3446575 | .001225490 |
| 817 | 667489 | 545338513 | 28.5832119 | 9.3484731 | .001223990 |
| 818 | 669124 | 547343432 | 28.6006993 | 9.3522857 | .001222494 |
| 819 | 670761 | 549353259 | 28.6181760 | 9.3560952 | .001221001 |
| 820 | 672400 | 551368000 | 28.6356421 | 9.3599016 | .001219512 |
| 821 | 674041 | 553387661 | 28.6530976 | 9.3637049 | .001218027 |
| 822 | 675684 | 555412248 | 28.6705424 | 9.3675051 | .001216545 |
| 823 | 677329 | 557441767 | 28.6879766 | 9.3713022 | .001215067 |
| 824 | 678976 | 559476224 | 28.7054002 | 9.3750963 | .001213592 |
| 825 | 680625 | 561515625 | 28.7228132 | 9.3788873 | .001212121 |
| 826 | 682276 | 563559976 | 28.7402157 | 9.3826752 | .001210654 |
| 827 | 683929 | 565609283 | 28.7576077 | 9.3864600 | .001209190 |
| 828 | 685584 | 567663552 | 28.7749891 | 9.3902419 | .001207729 |
| 829 | 687241 | 569722789 | 28.7923601 | 9.3940206 | .001206273 |
| 830 | 688900 | 571787000 | 28.8097206 | 9.3977964 | .001204819 |
| 831 | 690561 | 573856191 | 28.8270706 | 9.4015691 | .001203369 |
| 832 | 692224 | 575930368 | 28.8444102 | 9.4053387 | .001201923 |
| 833 | 693889 | 578009537 | 28.8617394 | 9.4091054 | .001200480 |
| 834 | 695556 | 580093704 | 28.8790582 | 9.4128690 | .001199041 |
| 835 | 697225 | 582182875 | 28.8963666 | 9.4166297 | .001197605 |
| 836 | 698896 | 584277056 | 28.9136646 | 9.4203873 | .001196172 |
| 837 | 700569 | 586376263 | 28.9309523 | 9.4241420 | .001194743 |
| 838 | 702244 | 588480472 | 28.9482297 | 9.4278936 | .001193317 |
| 839 | 703921 | 590589719 | 28.9654967 | 9.4316423 | .001191895 |
| 840 | 705600 | 592704000 | 28.9827535 | 9.4353880 | .001190476 |
| 841 | 707281 | 594823321 | 29.0000000 | 9.4391207 | .001189061 |
| 842 | 708964 | 596947688 | 29.0172363 | 9.4428704 | .001187648 |
| 843 | 710649 | 599077107 | 29.0344623 | 9.4466072 | .001186240 |
| 844 | 712336 | 601211584 | 29.0516781 | 9.4503410 | .001184834 |
| 845 | 714025 | 603351125 | 29.0688837 | 9.4540719 | .001183432 |
| 846 | 715716 | 605495736 | 29.0860791 | 9.4577999 | .001182033 |
| 847 | 717409 | 607645423 | 29.1032644 | 9.4615249 | .001180638 |
| 848 | 719104 | 609800192 | 29.1204396 | 9.4652470 | .001179245 |
| 849 | 720801 | 611960049 | 29.1376046 | 9.4689661 | .001177856 |
| 850 | 722500 | 614125000 | 29.1547595 | 9.4726824 | .001176471 |
| 851 | 724201 | 616295051 | 29.1719043 | 9.4763957 | .001175088 |
| 852 | 725904 | 618470208 | 29.1890390 | 9.4801061 | .001173709 |
| 853 | 727609 | 620650477 | 29.2061637 | 9.4838136 | .001172333 |
| 854 | 729316 | 622835864 | 29.2232784 | 9.4875182 | .001170960 |
| 855 | 731025 | 625026375 | 29.2403830 | 9.4912200 | .001169591 |
| 856 | 732736 | 627222016 | 29.2574777 | 9.4949188 | .001168224 |
| 857 | 734449 | 629422793 | 29.2745623 | 9.4986147 | .001166861 |
| 858 | 736164 | 631628712 | 29.2916370 | 9.5023078 | .001165501 |
| 859 | 737881 | 633839779 | 29.3087018 | 9.5059980 | .001164144 |
| 860 | 739600 | 636056000 | 29.3257566 | 9.5096854 | .001162791 |
| 861 | 741321 | 638277381 | 29.3428015 | 9.5133699 | .001161440 |
| 862 | 743044 | 640503928 | 29.3598365 | 9.5170515 | .001160093 |
| 863 | 744769 | 642735647 | 29.3768616 | 9.5207303 | .001158749 |
| 864 | 746496 | 644972544 | 29.3938769 | 9.5244063 | .001157407 |
| 865 | 748225 | 647214625 | 29.4108823 | 9.5280794 | .001156069 |
| 866 | 749956 | 649461896 | 29.4278779 | 9.5317497 | .001154734 |
| 867 | 751689 | 651714363 | 29.4448637 | 9.5354172 | .001153403 |
| 868 | 753424 | 653972032 | 29.4618397 | 9.5390818 | .001152074 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 869 | 755161 | 656234909 | 29.4788059 | 9.5427437 | .001150748 |
| 870 | 756900 | 658503000 | 29.4957624 | 9.5464027 | .001149425 |
| 871 | 758641 | 660776311 | 29.5127091 | 9.5500589 | .001148106 |
| 872 | 760384 | 663054848 | 29.5296461 | 9.5537123 | .001146789 |
| 873 | 762129 | 665338617 | 29.5465734 | 9.5573630 | .001145475 |
| 874 | 763876 | 667627624 | 29.5634910 | 9.5610108 | .001144165 |
| 875 | 765625 | 669921875 | 29.5803989 | 9.5646559 | .001142857 |
| 876 | 767376 | 672221376 | 29.5972972 | 9.5682982 | .001141553 |
| 877 | 769129 | 674526133 | 29.6141858 | 9.5719377 | .001140251 |
| 878 | 770884 | 676836152 | 29.6310648 | 9.5755745 | .001138952 |
| 879 | 772641 | 679151439 | 29.6479342 | 9.5792085 | .001137656 |
| 880 | 774400 | 681472000 | 29.6647939 | 9.5828397 | .001136364 |
| 881 | 776161 | 683797841 | 29.6816442 | 9.5864682 | .001135074 |
| 882 | 777924 | 686128968 | 29.6984848 | 9.5900939 | .001133787 |
| 883 | 779689 | 688465387 | 29.7153159 | 9.5937169 | .001132503 |
| 884 | 781456 | 690807104 | 29.7321375 | 9.5973373 | .001131222 |
| 885 | 783225 | 693154125 | 29.7489496 | 9.6009548 | .001129944 |
| 886 | 784996 | 695506456 | 29.7657521 | 9.6045696 | .001128668 |
| 887 | 786769 | 697864103 | 29.7825452 | 9.6081817 | .001127396 |
| 888 | 788544 | 700227072 | 29.7993289 | 9.6117911 | .001126126 |
| 889 | 790321 | 702595369 | 29.8161030 | 9.6153977 | .001124859 |
| 890 | 792100 | 704969000 | 29.8328678 | 9.6190017 | .001123596 |
| 891 | 793881 | 707347971 | 29.8496231 | 9.6226030 | .001122334 |
| 892 | 795664 | 709732288 | 29.8663690 | 9.6262016 | .001121076 |
| 893 | 797449 | 712121957 | 29.8831056 | 9.6297975 | .001119821 |
| 894 | 799236 | 714516984 | 29.8998328 | 9.6333907 | .001118568 |
| 895 | 801025 | 716917375 | 29.9165506 | 9.6369812 | .001117318 |
| 896 | 802816 | 719323136 | 29.9332591 | 9.6405690 | .001116071 |
| 897 | 804609 | 721734273 | 29.9499583 | 9.6441542 | .001114827 |
| 898 | 806404 | 724150792 | 29.9666481 | 9.6477367 | .001113586 |
| 899 | 808201 | 726572699 | 29.9833287 | 9.6513166 | .001112347 |
| 900 | 810000 | 729000000 | 30.0000000 | 9.6548938 | .001111111 |
| 901 | 811801 | 731432701 | 30.0166620 | 9.6584684 | .001109878 |
| 902 | 813604 | 733870808 | 30.0333148 | 9.6620403 | .001108647 |
| 903 | 815409 | 736314327 | 30.0499584 | 9.6656096 | .001107420 |
| 904 | 817213 | 738763264 | 30.0665928 | 9.6691762 | .001106195 |
| 905 | 819025 | 741217625 | 30.0832179 | 9.6727403 | .001104972 |
| 906 | 820836 | 743677416 | 30.0998339 | 9.6763017 | .001103753 |
| 907 | 822649 | 746142643 | 30.1164407 | 9.6798604 | .001102536 |
| 908 | 824464 | 748613312 | 30.1330383 | 9.6834166 | .001101322 |
| 909 | 826281 | 751089429 | 30.1496269 | 9.6869701 | .001100110 |
| 910 | 828100 | 753571000 | 30.1662063 | 9.6905211 | .001098901 |
| 911 | 829921 | 756058031 | 30.1827765 | 9.6940694 | .001097695 |
| 912 | 831744 | 758550528 | 30.1993377 | 9.6976151 | .001096491 |
| 913 | 833569 | 761048497 | 30.2158899 | 9.7011583 | .001095290 |
| 914 | 835396 | 763551944 | 30.2324329 | 9.7046989 | .001094092 |
| 915 | 837225 | 766060875 | 30.2489669 | 9.7082369 | .001092896 |
| 916 | 839056 | 768575296 | 30.2654919 | 9.7117723 | .001091703 |
| 917 | 840889 | 771095213 | 30.2820079 | 9.7153051 | .001090513 |
| 918 | 842724 | 773620632 | 30.2985148 | 9.7188354 | .001089325 |
| 919 | 844561 | 776151559 | 30.3150128 | 9.7223631 | .001088139 |
| 920 | 846400 | 778688000 | 30.3315018 | 9.7258883 | .001086957 |
| 921 | 848241 | 781229961 | 30.3479818 | 9.7294109 | .001085776 |
| 922 | 850084 | 783777448 | 30.3644529 | 9.7329309 | .001084599 |
| 923 | 851929 | 786330467 | 30.3809151 | 9.7364484 | .001083423 |
| 924 | 853776 | 788889024 | 30.3973683 | 9.7399634 | .001082251 |
| 925 | 855625 | 791453125 | 30.4138127 | 9.7434758 | .001081081 |
| 926 | 857476 | 794022776 | 30.4302481 | 9.7469857 | .001079914 |
| 927 | 859329 | 796597983 | 30.4466747 | 9.7504930 | .001078749 |
| 928 | 861184 | 799178752 | 30.4630924 | 9.7539979 | .001077586 |
| 929 | 863041 | 801765089 | 30.4795013 | 9.7575002 | .001076426 |
| 930 | 864900 | 804357000 | 30.4959014 | 9.7610001 | .001075269 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 931 | 866761 | 806954491 | 30.5122926 | 9.7644974 | .001074114 |
| 932 | 868624 | 809557568 | 30.5286750 | 9.7679922 | .001072961 |
| 933 | 870489 | 812166237 | 30.5450487 | 9.7714845 | .001071811 |
| 934 | 872356 | 814780504 | 30.5614136 | 9.7749743 | .001070664 |
| 935 | 874225 | 817400375 | 30.5777697 | 9.7784616 | .001069519 |
| 936 | 876096 | 820025856 | 30.5941171 | 9.7819466 | .001068376 |
| 937 | 877969 | 822656953 | 30.6104557 | 9.7854288 | .001067236 |
| 938 | 879844 | 825293672 | 30.6267857 | 9.7889087 | .001066098 |
| 939 | 881721 | 827936019 | 30.6431069 | 9.7923861 | .001064963 |
| 940 | 883600 | 830584000 | 30.6594194 | 9.7958611 | .001063830 |
| 941 | 885481 | 833237621 | 30.6757233 | 9.7993336 | .001062699 |
| 942 | 887364 | 835896888 | 30.6920185 | 9.8028036 | .001061571 |
| 943 | 889249 | 838561807 | 30.7083051 | 9.8062711 | .001060445 |
| 944 | 891136 | 841232384 | 30.7245830 | 9.8097362 | .001059322 |
| 945 | 893025 | 843908625 | 30.7408523 | 9.8131989 | .001058201 |
| 946 | 894916 | 846590536 | 30.7571130 | 9.8166591 | .001057082 |
| 947 | 896809 | 849278123 | 30.7733651 | 9.8201169 | .001055966 |
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| 963 | 927369 | 893056347 | 31.0322413 | 9.8751135 | .001038422 |
| 964 | 929296 | 895841344 | 31.0483494 | 9.8785305 | .001037344 |
| 965 | 931225 | 898632125 | 31.0644491 | 9.8819451 | .001036269 |
| 966 | 933156 | 901428696 | 31.0805405 | 9.8853574 | .001035197 |
| 967 | 935089 | 904231063 | 31.0966236 | 9.8887673 | .001034126 |
| 968 | 937024 | 907039232 | 31.1126984 | 9.8921749 | .001033058 |
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| 973 | 946729 | 921167317 | 31.1929479 | 9.9091776 | .001027749 |
| 974 | 948676 | 924010424 | 31.2089731 | 9.9125712 | .001026694 |
| 975 | 950625 | 926859375 | 31.2249900 | 9.9159624 | .001025641 |
| 976 | 952576 | 929714176 | 31.2409987 | 9.9193513 | .001024590 |
| 977 | 954529 | 932574833 | 31.2569992 | 9.9227379 | .001023541 |
| 978 | 956484 | 935441352 | 31.2729915 | 9.9261222 | .001022495 |
| 979 | 958441 | 938313739 | 31.2889757 | 9.9295042 | .001021450 |
| 980 | 960400 | 941192000 | 31.3049517 | 9.9328839 | .001020408 |
| 981 | 962361 | 944076141 | 31.3209195 | 9.9362613 | .001019368 |
| 982 | 964324 | 946966168 | 31.3368792 | 9.9396363 | .001018330 |
| 983 | 966289 | 949862087 | 31.3528308 | 9.9430092 | .001017294 |
| 984 | 968256 | 952763904 | 31.3687743 | 9.9463797 | .001016260 |
| 985 | 970225 | 955671625 | 31.3847097 | 9.9497479 | .001015228 |
| 986 | 972196 | 958585256 | 31.4006369 | 9.9531138 | .001014199 |
| 987 | 974169 | 961504803 | 31.4165561 | 9.9564775 | .001013171 |
| 988 | 976144 | 964430272 | 31.4324673 | 9.9598389 | .001012146 |
| 989 | 978121 | 967361669 | 31.4483704 | 9.9631981 | .001011122 |
| 990 | 980100 | 970299000 | 31.4642654 | 9.9665549 | .001010101 |
| 991 | 982081 | 973242271 | 31.4801525 | 9.9699095 | .001009082 |
| 992 | 984064 | 976191488 | 31.4960315 | 9.9732619 | .001008065 |

| No. | Squares | Cubes | Square roots | Cube roots | Reciprocals |
|---|---|---|---|---|---|
| 993 | 986049 | 979146657 | 31.5119025 | 9.9766120 | .001007049 |
| 994 | 988036 | 982107784 | 31.5277655 | 9.9799599 | .001006036 |
| 995 | 990025 | 985074875 | 31.5436206 | 9.9833055 | .001005025 |
| 996 | 992016 | 988047936 | 31.5594677 | 9.9866488 | .001004016 |
| 997 | 994009 | 991026973 | 31.5753068 | 9.9899900 | .001003009 |
| 998 | 996004 | 994011992 | 31.5911380 | 9.9933289 | .001002004 |
| 999 | 998001 | 997002999 | 31.6069613 | 9.9966656 | .001001001 |
| 1000 | 1000000 | 1000000000 | 31.6227766 | 10.0000000 | .001000000 |
| 1001 | 1002001 | 1003003001 | 31.6385840 | 10.0033322 | .0009990010 |
| 1002 | 1004004 | 1006012008 | 31.6543836 | 10.0066622 | .0009980040 |
| 1003 | 1006009 | 1009027027 | 31.6701752 | 10.0099899 | .0009970090 |
| 1004 | 1008016 | 1012048064 | 31.6859590 | 10.0133155 | .0009960159 |
| 1005 | 1010025 | 1015075125 | 31.7017349 | 10.0166389 | .0009950249 |
| 1006 | 1012036 | 1018108216 | 31.7175030 | 10.0199601 | .0009940358 |
| 1007 | 1014049 | 1021147343 | 31.7332633 | 10.0232791 | .0009930487 |
| 1008 | 1016064 | 1024192512 | 31.7490157 | 10.0265958 | .0009920635 |
| 1009 | 1018081 | 1027243729 | 31.7647603 | 10.0299104 | .0009910803 |
| 1010 | 1020100 | 1030301000 | 31.7804972 | 10.0332228 | .0009900990 |
| 1011 | 1022121 | 1033364331 | 31.7962262 | 10.0365330 | .0009891197 |
| 1012 | 1024144 | 1036433728 | 31.8119474 | 10.0398410 | .0009881423 |
| 1013 | 1026169 | 1039509197 | 31.8276609 | 10.0431469 | .0009871668 |
| 1014 | 1028196 | 1042590744 | 31.8433666 | 10.0464506 | .0009861933 |
| 1015 | 1030225 | 1045678375 | 31.8590646 | 10.0497521 | .0009852217 |
| 1016 | 1032256 | 1048772096 | 31.8747549 | 10.0530514 | .0009842520 |
| 1017 | 1034289 | 1051871913 | 31.8904374 | 10.0563485 | .0009832842 |
| 1018 | 1036324 | 1054977832 | 31.9061123 | 10.0596435 | .0009823183 |
| 1019 | 1038361 | 1058089859 | 31.9217794 | 10.0629364 | .0009813543 |
| 1020 | 1040400 | 1061208000 | 31.9374388 | 10.0662271 | .0009803922 |
| 1021 | 1042441 | 1064332261 | 31.9530906 | 10.0695156 | .0009794319 |
| 1022 | 1044484 | 1067462648 | 31.9687347 | 10.0728020 | .0009784736 |
| 1023 | 1046529 | 1070599167 | 31.9843712 | 10.0760863 | .0009775171 |
| 1024 | 1048576 | 1073741824 | 32.0000000 | 10.0793684 | .0009765625 |
| 1025 | 1050625 | 1076890625 | 32.0156212 | 10.0826484 | .0009756098 |
| 1026 | 1052676 | 1080045576 | 32.0312348 | 10.0859262 | .0009746589 |
| 1027 | 1054729 | 1083206683 | 32.0468407 | 10.0892019 | .0009737098 |
| 1028 | 1056784 | 1086373952 | 32.0624391 | 10.0924755 | .0009727626 |
| 1029 | 1058841 | 1089547389 | 32.0780298 | 10.0957469 | .0009718173 |
| 1030 | 1060900 | 1092727000 | 32.0936131 | 10.0990163 | .0009708738 |
| 1031 | 1062961 | 1095912791 | 32.1091887 | 10.1022835 | .0009699321 |
| 1032 | 1065024 | 1099104768 | 32.1247568 | 10.1055487 | .0009689922 |
| 1033 | 1067089 | 1102302937 | 32.1403173 | 10.1088117 | .0009680542 |
| 1034 | 1069156 | 1105507304 | 32.1558704 | 10.1120726 | .0009671180 |
| 1035 | 1071225 | 1108717875 | 32.1714159 | 10.1153314 | .0009661836 |
| 1036 | 1073296 | 1111934656 | 32.1869539 | 10.1185882 | .0009652510 |
| 1037 | 1075369 | 1115157653 | 32.2024844 | 10.1218428 | .0009643202 |
| 1038 | 1077444 | 1118386872 | 32.2180074 | 10.1250953 | .0009633911 |
| 1039 | 1079521 | 1121622319 | 32.2335229 | 10.1283457 | .0009624639 |
| 1040 | 1081600 | 1124864000 | 32.2490310 | 10.1315941 | .0009615385 |
| 1041 | 1083681 | 1128111921 | 32.2645316 | 10.1348403 | .0009606148 |
| 1042 | 1085764 | 1131366088 | 32.2800248 | 10.1380845 | .0009596929 |
| 1043 | 1087849 | 1134626507 | 32.2955105 | 10.1413266 | .0009587738 |
| 1044 | 1089936 | 1137893184 | 32.3109888 | 10.1445667 | .0009578544 |
| 1045 | 1092025 | 1141166125 | 32.3264598 | 10.1478047 | .0009569378 |
| 1046 | 1094116 | 1144445336 | 32.3419233 | 10.1510406 | .0009560229 |
| 1047 | 1096209 | 1147730823 | 32.3573794 | 10.1542744 | .0009551098 |
| 1048 | 1098304 | 1151022592 | 32.3728281 | 10.1575062 | .0009541985 |
| 1049 | 1100401 | 1154320649 | 32.3882695 | 10.1607359 | .0009532888 |
| 1050 | 1102500 | 1157625000 | 32.4037035 | 10.1639636 | .0009523810 |
| 1051 | 1104601 | 1160935651 | 32.4191301 | 10.1671893 | .0009514748 |
| 1052 | 1106704 | 1164252608 | 32.4345495 | 10.1704129 | .0009505703 |
| 1053 | 1108809 | 1167575877 | 32.4499615 | 10.1736344 | .0009496676 |
| 1054 | 1110916 | 1170905464 | 32.4653662 | 10.1768539 | .0009487666 |

**Weights in Pounds per Square Foot of Sheets of Wrought Iron, Steel, Copper, and Brass**

Thickness by American (Brown & Sharpe) gauge *

| No. of gauge | Thickness in inches | Iron | Steel | Copper | Brass |
|---|---|---|---|---|---|
| 0000 | 0.46 | 18.40 | 18.77 | 20.84 | 19.69 |
| 000 | 0.4096 | 16.39 | 16.71 | 18.56 | 17.53 |
| 00 | 0.3648 | 14.59 | 14.88 | 16.53 | 15.61 |
| 0 | 0.3249 | 12.99 | 13.25 | 14.72 | 13.90 |
| 1 | 0.2893 | 11.57 | 11.80 | 13.11 | 12.38 |
| 2 | 0.2576 | 10.31 | 10.51 | 11.67 | 11.03 |
| 3 | 0.2294 | 9.18 | 9.36 | 10.39 | 9.82 |
| 4 | 0.2043 | 8.17 | 8.34 | 9.26 | 8.74 |
| 5 | 0.1819 | 7.28 | 7.42 | 8.24 | 7.79 |
| 6 | 0.1620 | 6.48 | 6.61 | 7.34 | 6.93 |
| 7 | 0.1443 | 5.77 | 5.89 | 6.54 | 6.18 |
| 8 | 0.1285 | 5.14 | 5.24 | 5.82 | 5.50 |
| 9 | 0.1144 | 4.58 | 4.67 | 5.18 | 4.90 |
| 10 | 0.1019 | 4.08 | 4.16 | 4.62 | 4.36 |
| 11 | 0.0907 | 3.63 | 3.70 | 4.11 | 3.88 |
| 12 | 0.0808 | 3.23 | 3.30 | 3.66 | 3.46 |
| 13 | 0.0720 | 2.88 | 2.94 | 3.26 | 3.08 |
| 14 | 0.0641 | 2.56 | 2.61 | 2.90 | 2.74 |
| 15 | 0.0571 | 2.28 | 2.33 | 2.59 | 2.44 |
| 16 | 0.0508 | 2.03 | 2.07 | 2.30 | 2.18 |
| 17 | 0.0453 | 1.81 | 1.85 | 2.05 | 1.94 |
| 18 | 0.0403 | 1.61 | 1.64 | 1.83 | 1.73 |
| 19 | 0.0359 | 1.44 | 1.46 | 1.63 | 1.54 |
| 20 | 0.0320 | 1.28 | 1.30 | 1.45 | 1.37 |
| 21 | 0.0285 | 1.14 | 1.16 | 1.29 | 1.22 |
| 22 | 0.0253 | 1.01 | 1.03 | 1.15 | 1.08 |
| 23 | 0.0226 | 0.903 | 0.921 | 1.02 | 0.966 |
| 24 | 0.0201 | 0.804 | 0.820 | 0.911 | 0.860 |
| 25 | 0.0179 | 0.716 | 0.730 | 0.811 | 0.766 |
| 26 | 0.0159 | 0.638 | 0.650 | 0.722 | 0.682 |
| 27 | 0.0142 | 0.568 | 0.579 | 0.643 | 0.608 |
| 28 | 0.0126 | 0.506 | 0.516 | 0.573 | 0.541 |
| 29 | 0.0113 | 0.450 | 0.459 | 0.510 | 0.482 |
| 30 | 0.0100 | 0.401 | 0.409 | 0.454 | 0.429 |
| 31 | 0.0089 | 0.357 | 0.364 | 0.404 | 0.382 |
| 32 | 0.0080 | 0.318 | 0.324 | 0.360 | 0.340 |
| 33 | 0.0071 | 0.283 | 0.289 | 0.321 | 0.303 |
| 34 | 0.0063 | 0.252 | 0.257 | 0.286 | 0.270 |
| 35 | 0.0056 | 0.224 | 0.229 | 0.254 | 0.240 |
| Specific gravity..... | | 7.704 | 7.85 | 8.72 | 8.24 |
| Weight per cubic foot..... | | 480.00 | 489.60 | 543.6 | 513.6 |
| Weight per cubic inch..... | | 0.2778 | 0.2833 | 0.3146 | 0.2972 |

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# Expert Pattern Work

Wood and metal patterns are made here by expert workmen in an efficient modern plant equipped with the latest improved wood and metal working machinery. Marion patterns are made accurately, delivered on time.

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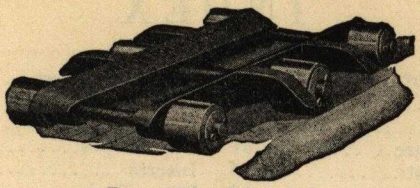
We are also able to deliver in any quantity castings in

| | |
|---|---|
| Malleable | Brass |
| Gray Iron | Bronze |
| Steel | Aluminum |

**Marion Malleable Iron Works**

**Marion, Indiana**



*Low Wheel Model*

**MARION**
**Dolly Trucks**

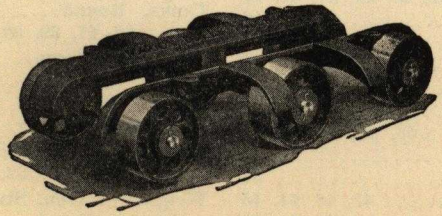
# For moving heavy, bulky, hard-to-get-hold-of loads

This truck, easily slipped under ugly loads, handles barrels, rolls, bundles, cases easily. Serves the far corners that conveyor systems don't reach. Sloping side-skids make loading easy from side or end. Marion Certified Malleable Iron frame cradles the load. Tool steel roller bearings roll the load smoothly, pivot it neatly.

***Ask for circular describing different models.***

## Marion Malleable Iron Works

**Marion, Indiana**



*High Wheel Model*

# INDEX


PAGE

Absorption of Aggregates. 60
Aggregates .....59, 60, 62
Bar Bender.....51, 52, 67
Board Measure.....49, 50, 51
Bucket, Hoist ..... 55
Cable Clips..... 10
Capacity of Cylinders..... 72
Capacity of Tank Bottoms. 72
Capacity, Rectangular Tanks 63
Capacity, Round Silos 69, 70, 71
Castings .....110
Circle, Areas and Circumferences.....79 to 91
Circle, Properties of..... 73
Clips, Cable..... 10
Clips Required for Guy Ropes ..... 53
Concrete Tables.....
.....59, 60, 61, 62, 64, 65, 69
Copper Rods, Weights of.. 74
Couplings, Hex.....4, 5
Couplings, Semi-Hex.....4, 5
Cubes.....92 to 108
Cube Roots.....92 to 108
Cylinders, Capacity of..... 72
Decimal Equivalents.76, 77, 78

Forms:

Beam .....17, 18, 37
Column .....16, 35, 36
Coping ..... 48
Drop Panel.....
...26, 27, 28, 29, 30, 31, 32
Floor ..... 46
Footing ..... 14
Girder .....17, 18
Joist ..... 19
Round.....66, 67, 68, 69, 70
Silo.....66, 67, 68, 69, 70
Slab ..... 17
Spandrel ..... 37
Stair .....42, 43, 44, 45
Tower.....39, 40, 41
Wall....15, 33, 34, 35, 36, 38
Window .....37, 47

PAGE

Form Spreaders.....4, 5
Form Ties.....5, 9
Form Tighteners.....8, 9
Guy Ropes..... 53
Inserts ..... 7
Lugs, Tank..... 11
Metals, Weights of.....
.....73, 74, 75, 109
Metric Measure..... 78
Mortar, Covering Capacity of 60
Mortar, Materials for..... 61
Mortar Tables.....60, 61
Patterns .....110
Platform, Hoist..... 55
Reciprocals .....92 to 108
Reinforcing Couplings....6, 7
Reinforcing, for Rectangular Tanks..... 68
Reinforcing, for Silos....68, 70
Reinforcing, for Circular Tanks.....68, 70
Rope Tables.....53, 56, 57
Ropes for Hoist Towers.... 53
Round Structures.....
.....66, 68, 69, 70, 71, 72
Slump Table..... 59
Spreaders, Form.....4, 5
Squares .....92 to 108
Square Roots .....92 to 108
Stucco, Covering Capacity of 60
Tank Bottoms, Capacity of. 72
Tank Lugs..... 11
Tanks, Rectangular.....63, 68
Tanks, Round.....
.....66, 67, 68, 69, 70, 71, 72
Tighteners, Form.....8, 9
Tower, Hoist..... 54
Trucks, Dolly.....109
Washers, Malleable..... 12
Weights of Materials.....
.....62, 73, 74, 75
Weights of Iron, Steel, Copper, Brass.....109
Wire Form Tighteners...8, 9
Wire Rope.....53, 56, 57, 58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